

TROUBLE-SHOOTING INSTRUCTIONS : ALF-5000  
BOSCH SYSTEM : Dist.-type fuel-inj. pump  
VEHICLE MAKE : ALFA-ROMEO

T A B L E O F C O N T E N T S

SECTION	COORDINATES
Special features.....	02
Test specifications.....	02
Preheating system terminal diagram.....	05
Test equipment and tools.....	07
Removing fuel-injection pump.....	08
Installing fuel-injection pump.....	14
Coordinating fuel-injection pump -> engine.....	22
Testing charge-air pressure.....	26

SPECIAL FEATURES

These trouble-shooting instructions apply to the following Alfa-Romeo models with turbo-diesel engine current at the time of writing:

- \* Alfa 33 1.8 l - 3 cylinders (10.86->)
- \* Alfetta Giulietta 2.0 l - 4 cylinders (03.83->)
- \* Alfa 75 2.0 l - 4 cylinders (05.85->)
- \* Alfa 90 2.4 l - 4 cylinders (10.84->)
- \* Alfetta 2.4 l - 4 cylinders (04.83->)
- \* Alfa 6 2.5 l - 5 cylinders (06.83->)

TEST SPECIFICATIONS

Idle speed	850 ± 50 min <sup>-1</sup>
Nozzle-opening pressure:	155 + 8 bar
Coordination of pump and engine	
Engine position	1rst cylinder at TDC
Pump position:	
1.8 l Turbo-Diesel	1.00...1.03 mm after BDC
2.0 l Turbo-Diesel	0.97...0.99 mm after BDC
2.4 l Turbo-Diesel	0.78...0.80 mm after BDC
2.5 l Turbo-Diesel	0.88...0.90 mm after BDC

TEST SPECIFICATIONS (CONTINUED)

Compression: 21...22 bar

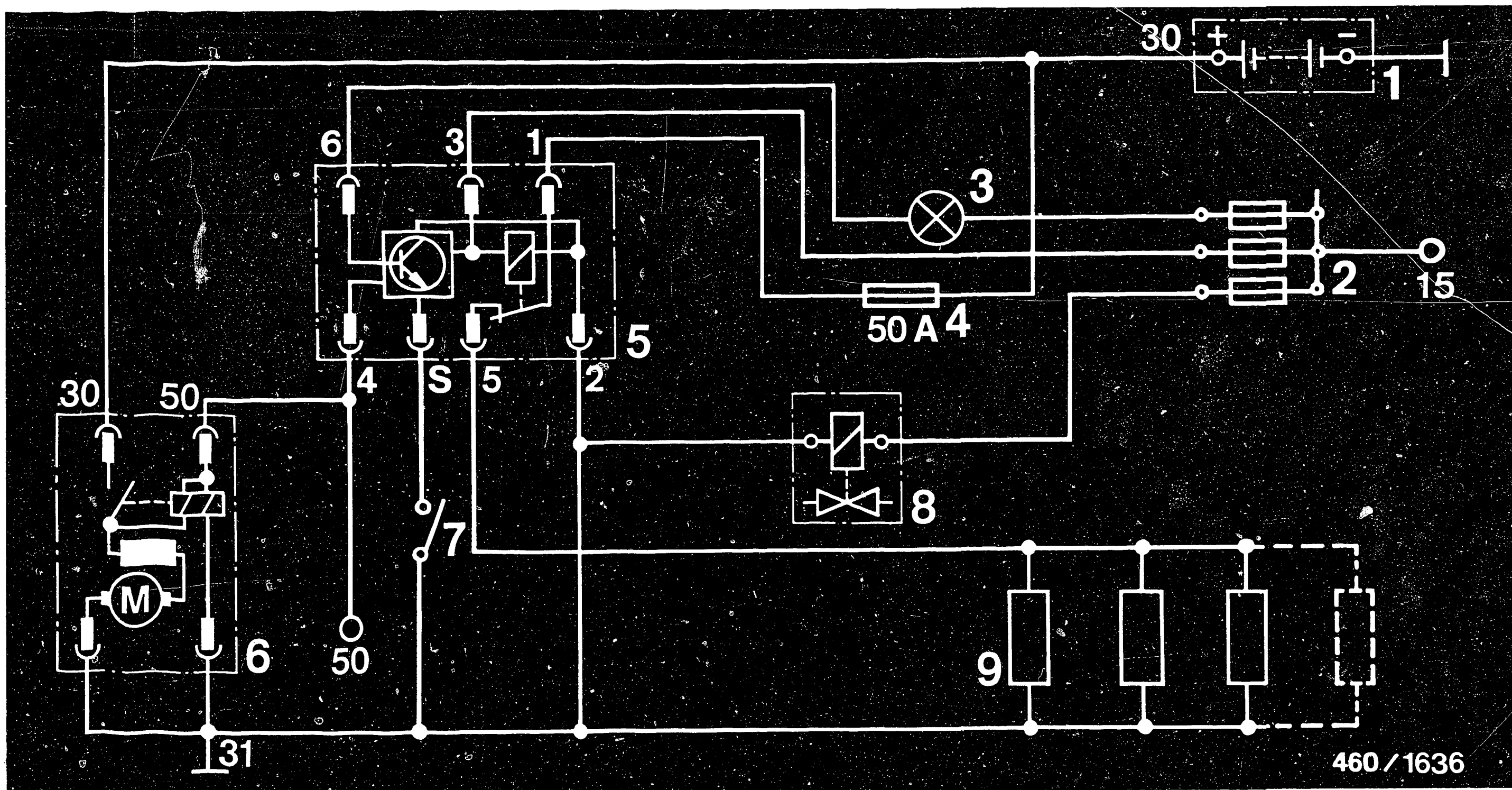
Charge-air pressure: 0.39...0.45 bar  
at 4000 min<sup>-1</sup>  
without loading,  
max. 0.88 bar at  
highest engine speed  
with loading

Tightening torques:

Fuel-injection pump gear	88 Nm
Nozzle-holder assembly	25...30 Nm
Fuel lines	15...20 Nm
Fastening bolts for fuel-injection pump	25 Nm
Fuel-line inlet-union screws	25 Nm
Screw plug	10 Nm

For production reasons:  
continued on the following  
coordinate.





460 / 1636

- 1 = Battery
- 2 = Fuse box
- 3 = Preheating indicator lamp
- 4 = 50 A fuse
- 5 = Glow-duration control relay

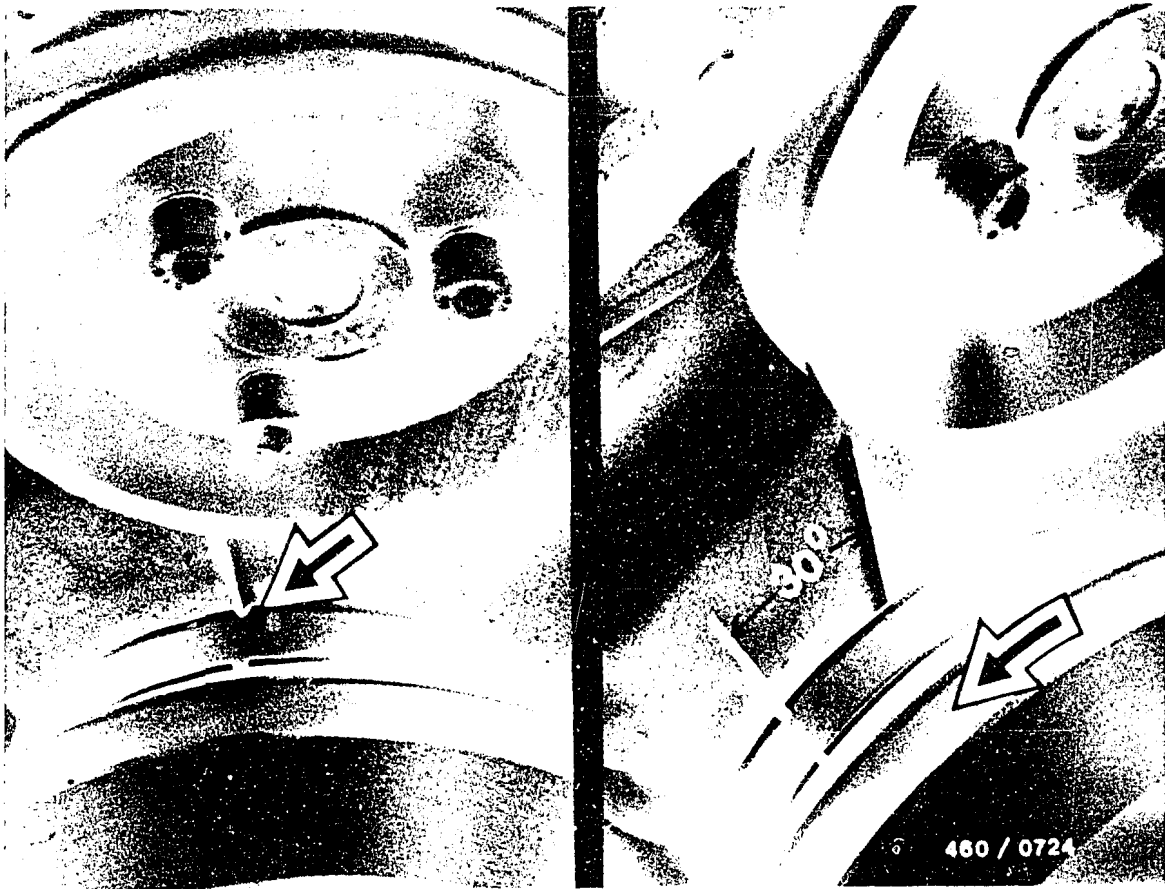
- 6 = Starting motor
- 7 = Microswitch (VE pump)
- 8 = Solenoid-operated valve
- 9 = Glow plugs

PREHEATING SYSTEM TERMINAL DIAGRAM

TEST EQUIPMENT AND TOOLS

Holding and pressing device *	A 7. 0 384 A 3. 0 612	Holding fuel-injection pump drive gear
Pressure-measuring device or pressure gauge, 0...1.6 bar	KDJE-P 100 e.g. W i k a No. 4 184	Testing charge-air pressure
Measuring device	KDEP 1085 KDEP 1126	Pump/engine coordination
Small dial indicator 1/100 mm graduation	1 687 233 011	Pump/engine coordination
Box wrench	KDEP 1115	Loosening/tightening fuel-injection tubing

\* = Obtain from Alfa-Romeo dealership



REMOVING THE FUEL-INJECTION PUMP

Disconnect the water hoses at the radiator and remove the radiator (only on 3-cylinder, 1.8 l, Turbo-Diesel)

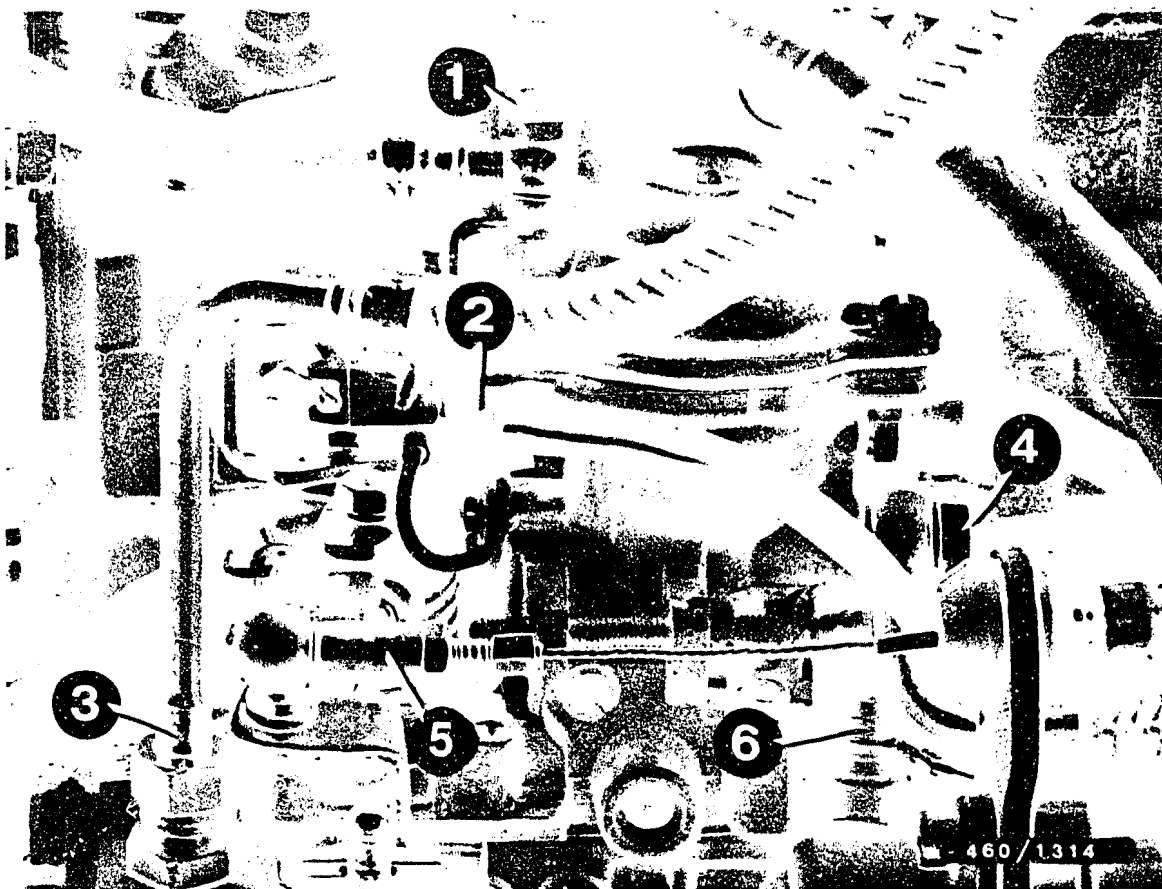
Remove cylinder-head cover.

Turn the crankshaft to TDC of cylinder 1 (on timing-gear side).

The marking on the control housing must be aligned with the belt-gear marking (Fig. a, arrow).

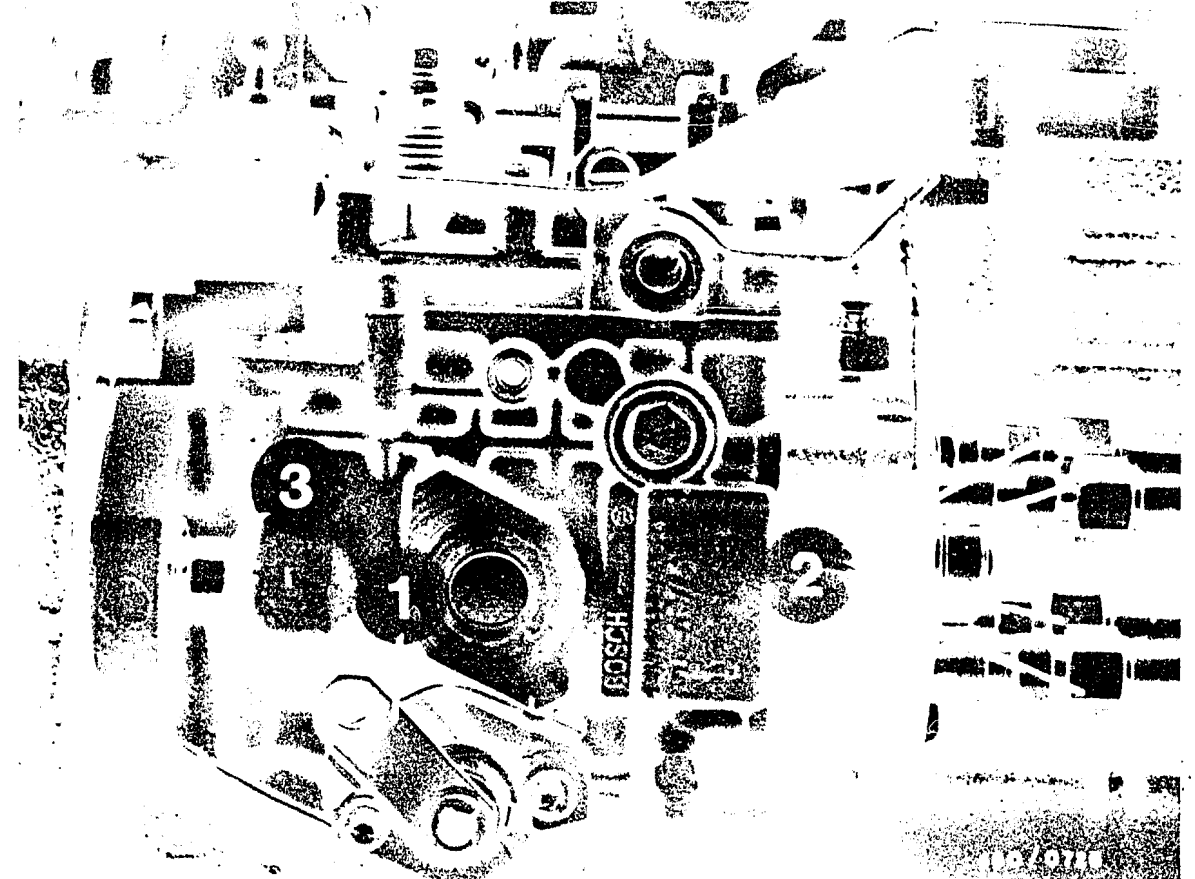
Turn the crankshaft 30° against the direction of engine rotation (Fig. b, direction of arrow).

Remove the battery.



- 1 = Charge-air pressure connection
- 2 = Microswitch  
(presence depends on engine type)
- 3 = Fuel supply line
- 4 = Fuel return line
- 5 = Bowden cable at control lever
- 6 = Connection line to ELAB

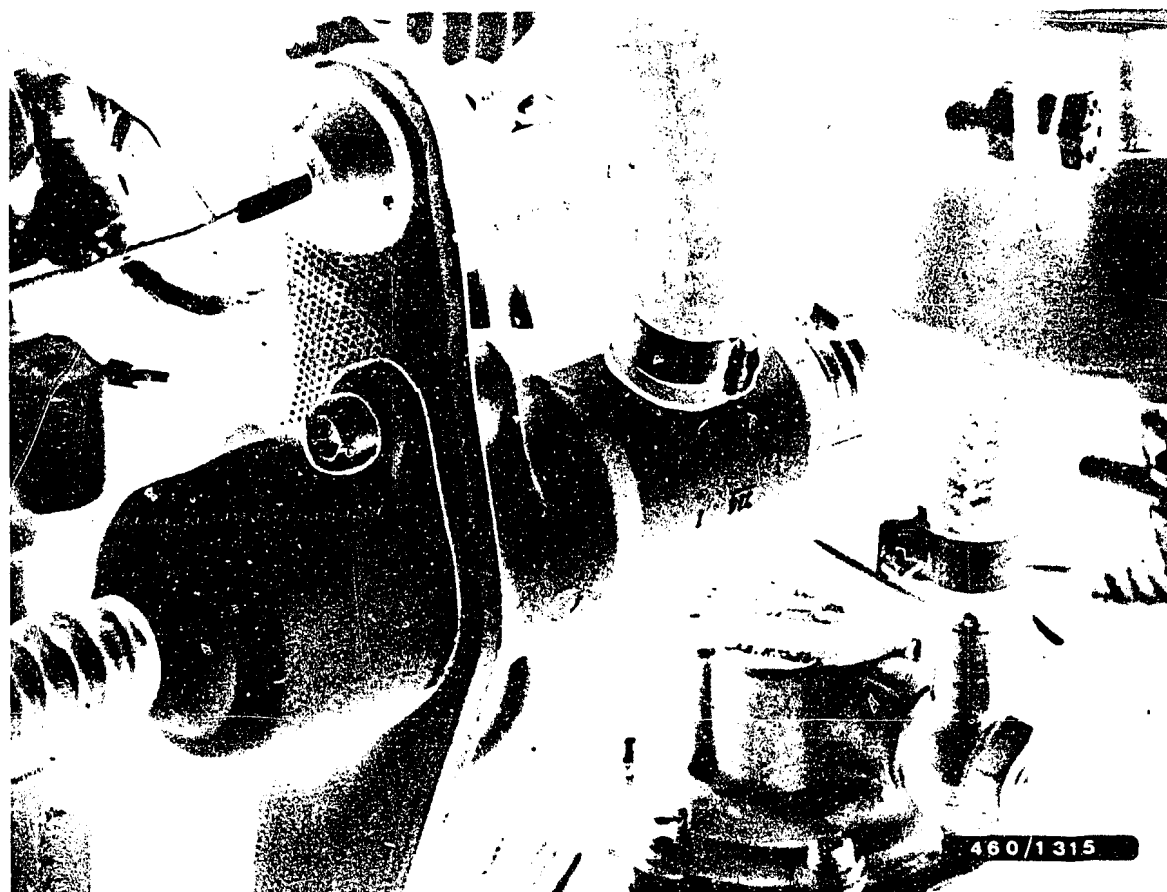
Remove the charge-air pressure connection, electric cable to microswitch, fuel supply line, return line, bowden cable at control lever of fuel-injection pump, and electric cable to shutoff solenoid.



- 1 = Bowden cable at cold-start inj. advance  
(presence depends upon engine type)
- 2 = Fuel-injection tubing
- 3 = Fastening nut

Remove the bowden cable at the cold-start injection advance and the fuel-injection tubing with box wrench KDEP 1115.  
(Prevent the delivery-valve holders from turning by counterholding.)

Unscrew the fuel-injection pump fastening nuts.

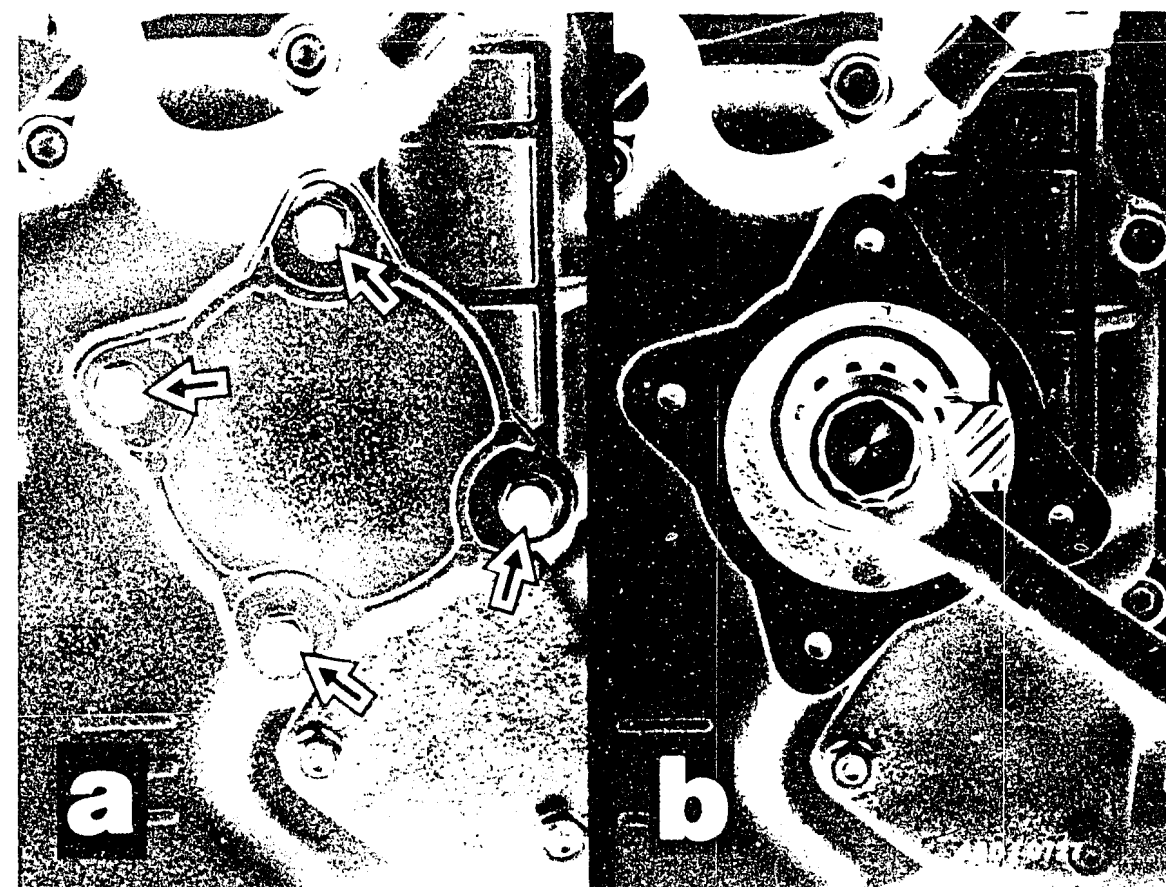


With fuel-injection pumps with temperature-controlled cold-start injection advance (KSB), pinch off the coolant hoses a short distance behind the control device of the injection pump with commercially available spring clips.

Loosen the hose clamps and pull off the coolant hoses.

Remove the fuel-injection tubing with box wrench KDEP 1115.  
(Prevent the delivery-valve holders from turning by counterholding.)

Unscrew the fuel-injection pump fastening nuts.



Remove the fastening bolts (Fig. a, arrows) from the cover of the injection-pump drive gear.

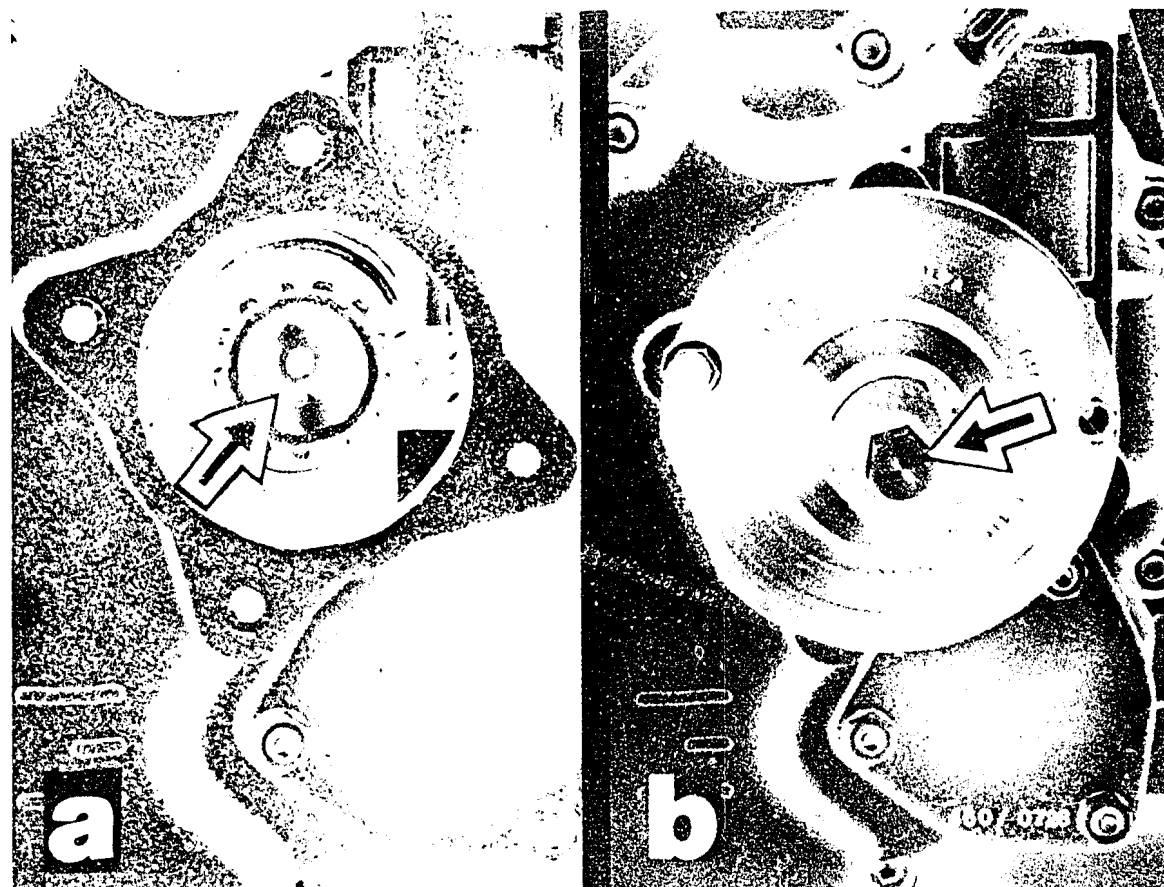
Remove the cover.

Unscrew the fuel-injection pump gear fastening screw (Fig. b).

In order to prevent the crankshaft from turning, put car into gear and pull the parking brake.

Note for removal:

On covers with screw-thread insert, use holding and pressing device A 3, 0 612 for the subsequent pump removal.



Screw holding and pressing device A 7. 0384, or A 3. 0612 into the drive gear of the vacuum pump (Fig. a, arrow).

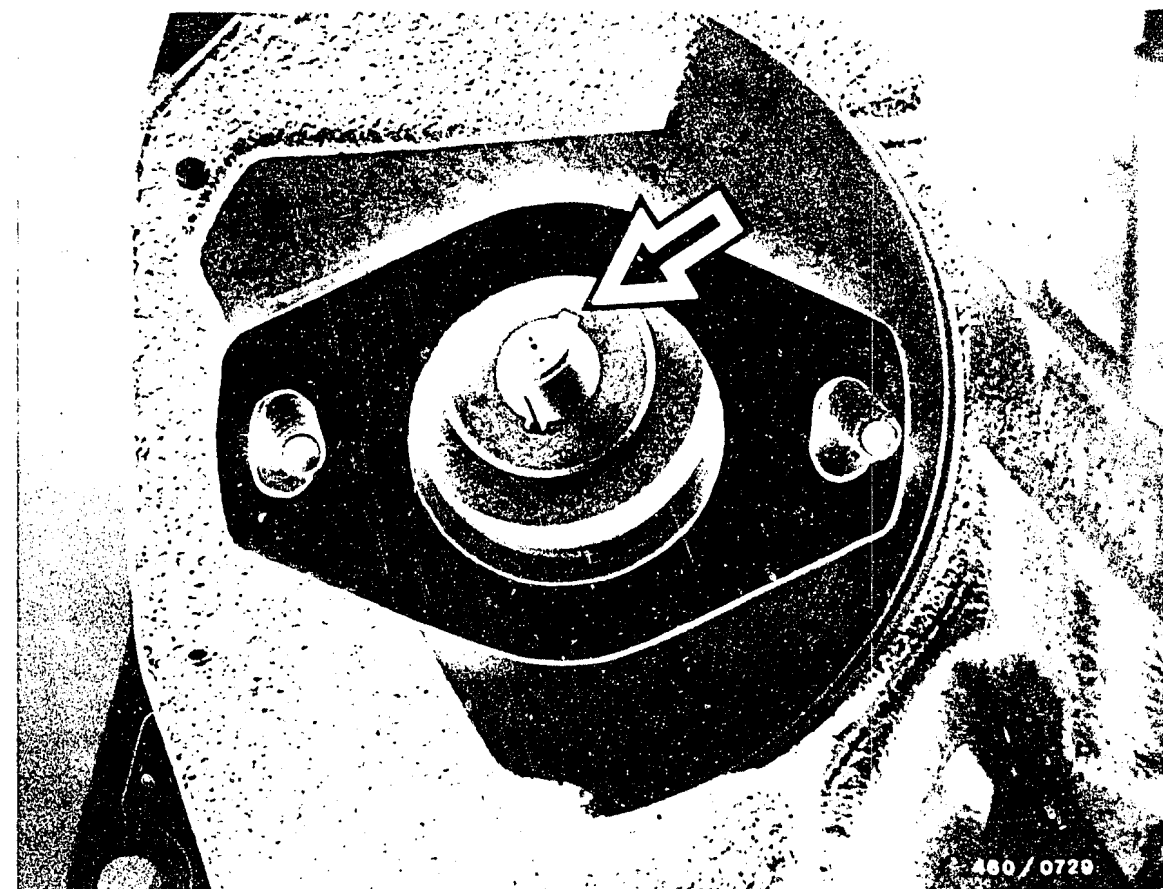
Lock the device with a bolt from the gear cover (Fig. b).

Press the injection-pump drive shaft out of the drive gear by screwing in the pressing screw (Fig. b, arrow).

Remove the fuel-injection pump from the engine.

**Note :**

Do not alter the crankshaft position with the holding device mounted.



#### INSTALLING THE FUEL-INJECTION PUMP

Turn the fuel-injection pump drive shaft until the keyway points to outlet "A".

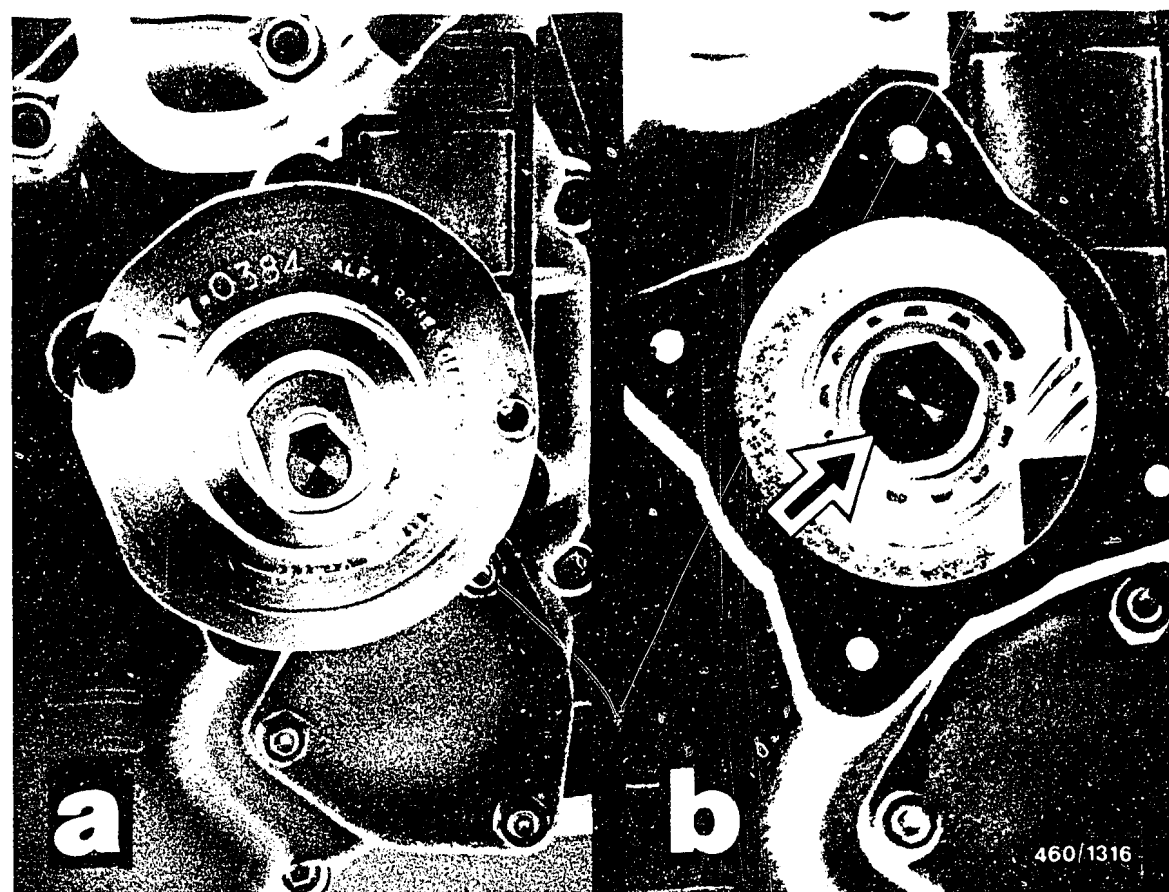
Install the injection pump in such a manner that the drive-shaft Woodruff key engages in the upper key space (arrow) of the drive gear.

#### Installation note :

To make installation easier, use grease to place the washer and spring lock washer of the rear stay bolt on the pump flange.

Pivot the fuel-injection pump into the middle position of the slots.

Put on and slightly tighten the fastening nuts.



Remove the holding and pressing device (Fig. a).

Screw in the fastening screw for the injection-pump gear and tighten to 88 Nm (Fig. b, arrow).

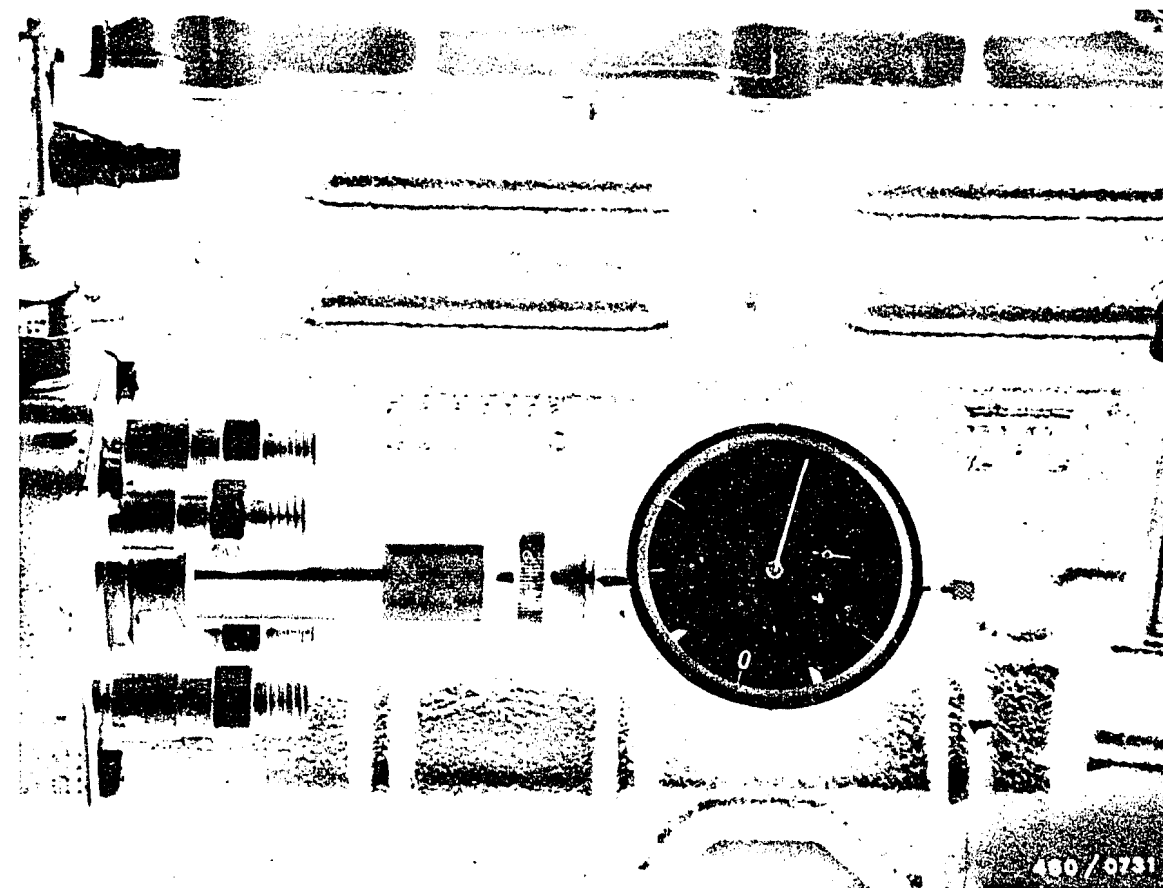
**Note :**

In order to prevent the crankshaft from turning, put vehicle in gear and pull the parking brake.

Mount the cover.

Disengage gear.

Turn the crankshaft in the direction of engine rotation until the marking on the belt gear is aligned with the TDC marking on the control housing.



Screw the bleeder screw out of the central screw plug (triangle-head bolt) of the distributor head.

Mount measuring device KDEP 1085 or 1126 with dial indicator, e.g. 1 687 233 011, in this hole, and pre-tension approx. 2 mm.

Turn the crankshaft against the direction of engine rotation until the needle of the dial indicator no longer moves.

Set the dial indicator to "0".

**Note :**

When testing and adjusting start of delivery, the temperature-controlled cold-start injection advance (where present) must be in zero position.





Turn the crankshaft in the direction of engine rotation until the belt gear marking is aligned with the TDC marking on the control housing (see illustration, arrow).

At this crankshaft position, the dial indicator on the injection pump should show a pump-piston stroke, depending on engine type, of:

1.8 l	Turbo-Diesel	1.00...1.03 mm
2.0 l	Turbo-Diesel	0.97...0.99 mm
2.4 l	Turbo-Diesel	0.78...0.80 mm
2.5 l	Turbo-Diesel	0.88...0.90 mm

after TDC.

Where necessary, undertake correction by pivoting the fuel-injection pump.

Tighten the fuel-injection pump fastening bolts to 25 Nm.

Remove measuring device KDEP 1085 or 1126 with dial indicator.

Screw in the bleeder screw with a new seal ring.

Tighten fuel-injection tubing with box wrench KDEP 1115 (prevent delivery-valve holders from turning by counterholding).

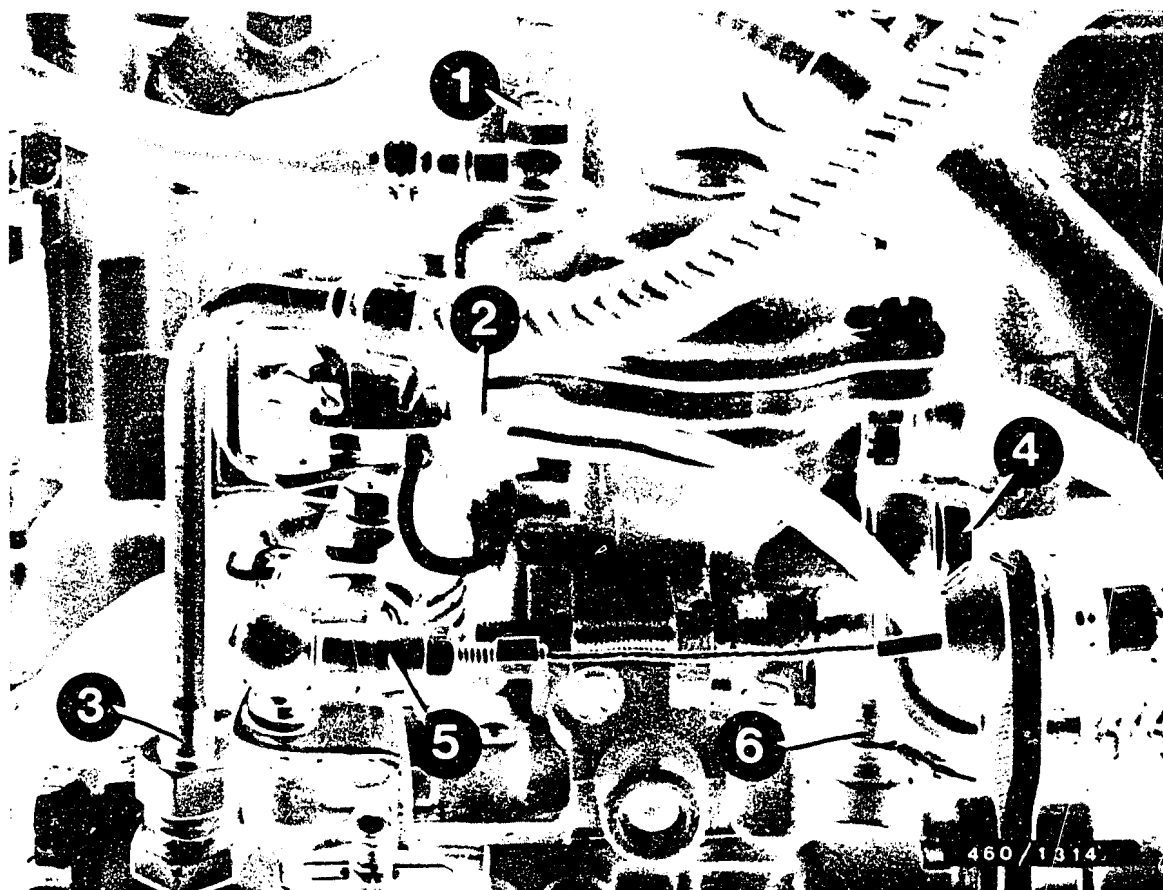
Connect the bowden cable to the cold-start injection advance and coolant lines to the control devices of the injection pump.

Tighten hose clamps and remove spring clips.

Mount the cylinder-head cover.

Install the battery.

Install the radiator (only on 3-cylinder 1.8 l Turbo-Diesel).

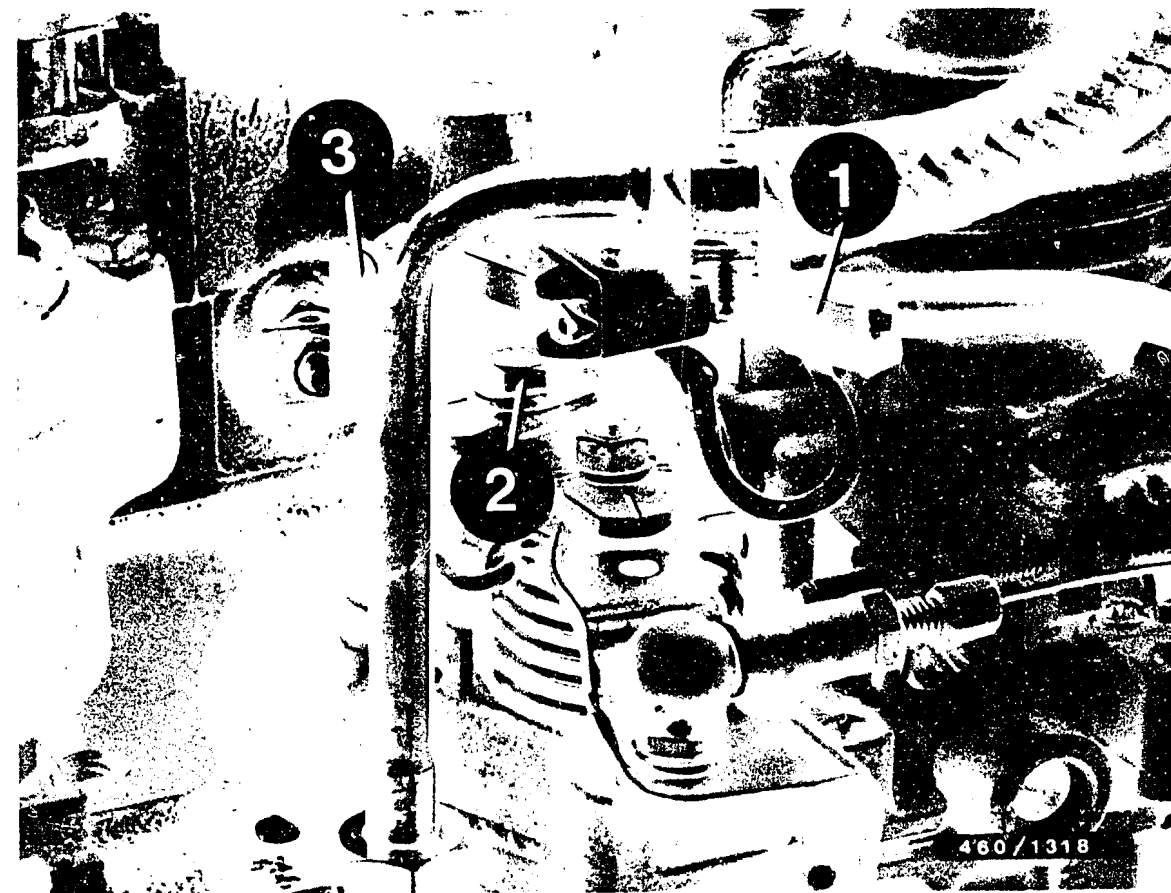


- 1 = Charge-air pressure connection
- 2 = Microswitch  
(presence depends on engine type)
- 3 = Fuel supply line
- 4 = Fuel return line
- 5 = Bowden cable at control lever
- 6 = Connection cable to ELAB

Restore the charge-air pressure connection, electric lead to microswitch, fuel supply line, return line, bowden cable at control lever of fuel-injection pump, and electric cable to shutoff solenoid.

Note :

The inlet-union screw of the fuel return line has a restriction bore, and is marked with the word " O U T " on the screw head.



- 1 = Plug connector
- 2 = Hex-head bolt
- 3 = Switch clip

Adjusting the microswitch to switch off the preheating system

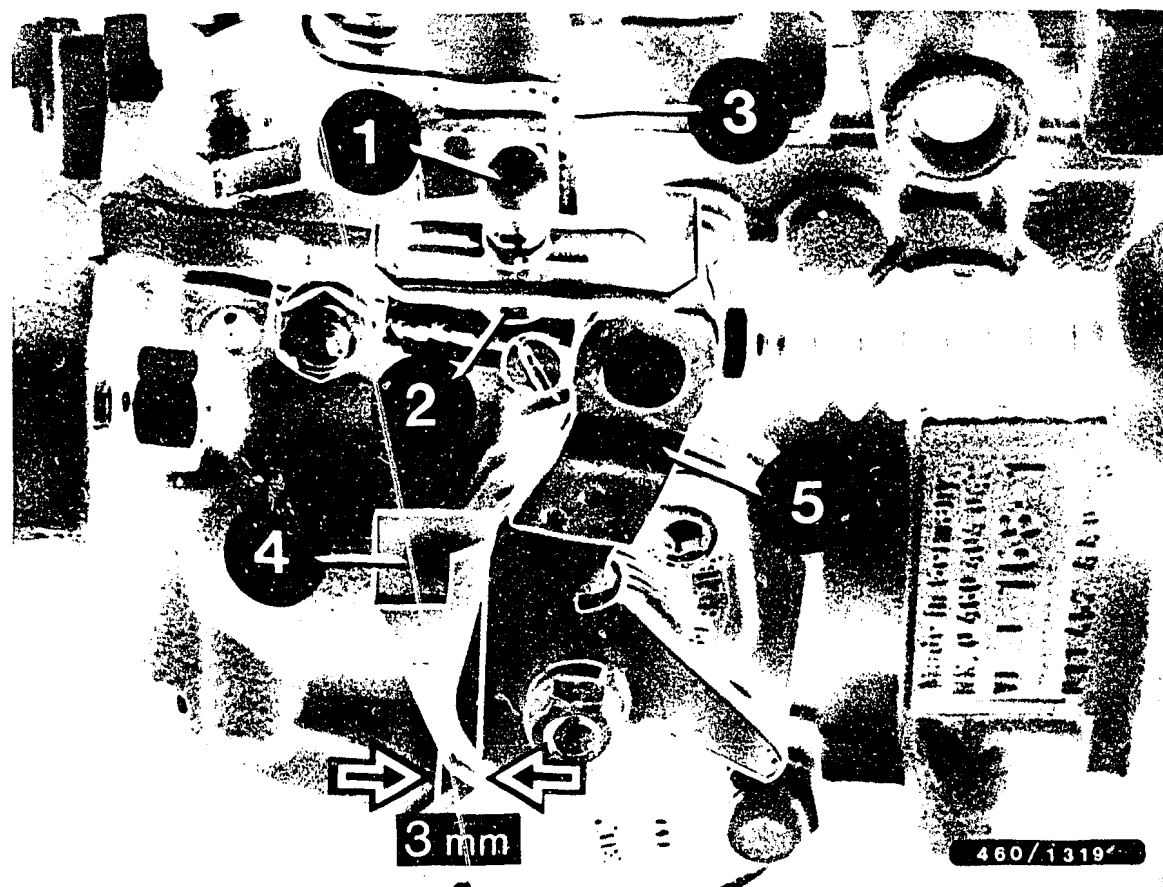
Prerequisite :  
\* Idle speed set.

Insert a 5.5 mm spacer between the control lever and the idle stop screw. Pull the plug connector from the microswitch. Connect the test lamp to the free connection of the microswitch and the battery positive terminal. Loosen the hex-head bolt and set the switching point of the microswitch by moving the switch clip.

Note :

This adjustment guarantees that the glow plugs are switched off in the post-heating phase above 1300...1900 min<sup>-1</sup> ..





- 1 = Ball head
- 2 = Hex nut
- 3 = Engine-speed control lever
- 4 = Stop
- 5 = Control lever (cam roller ring)

#### Adjusting idle increase

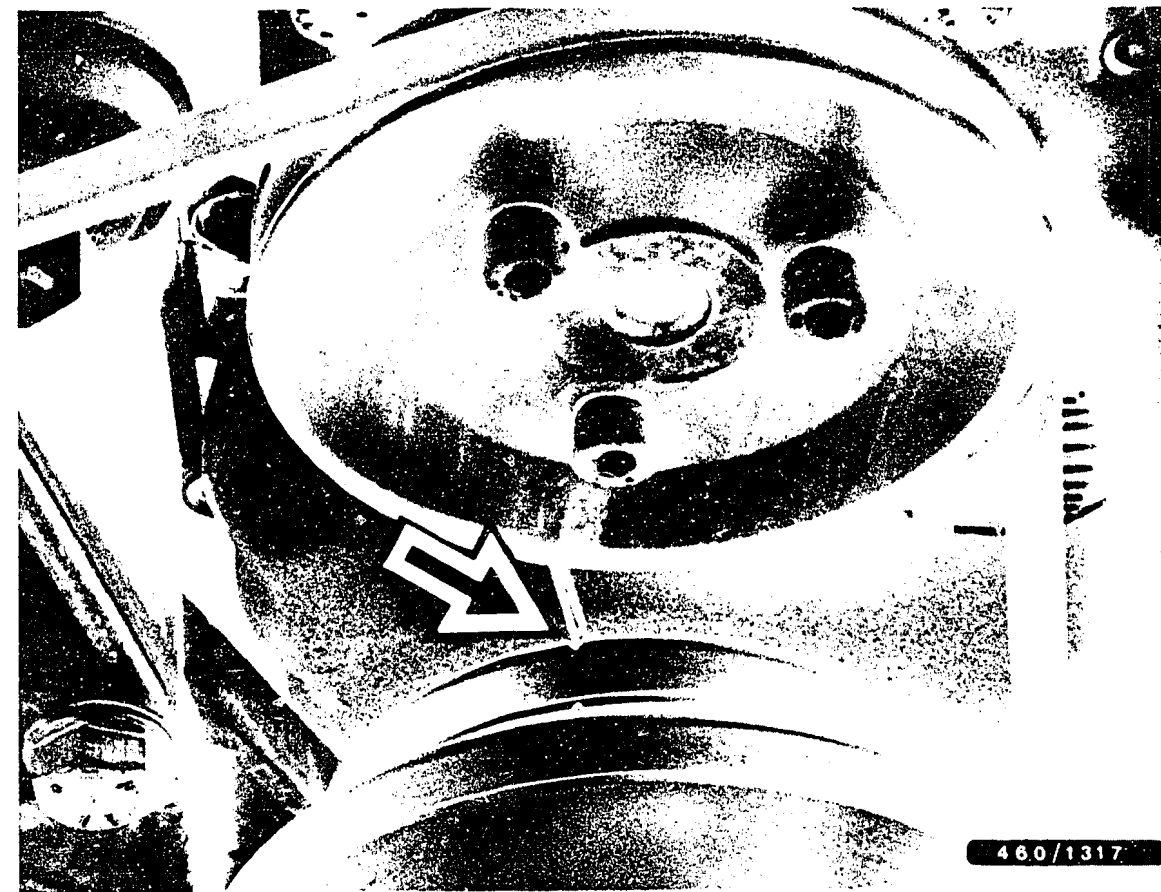
##### Prerequisite:

- \* Idle speed set
- \* Coolant temperature at least 40° C

Disengage the throttle cable from the control lever. Insert a 3 mm spacer between the control lever and stop.

Start the engine and run at 1000...1100 min<sup>-1</sup>.

Loosen the hex nut and position the ball head at the control lever. Tighten the hex nut, remove the spacer, and fasten the throttle cable.



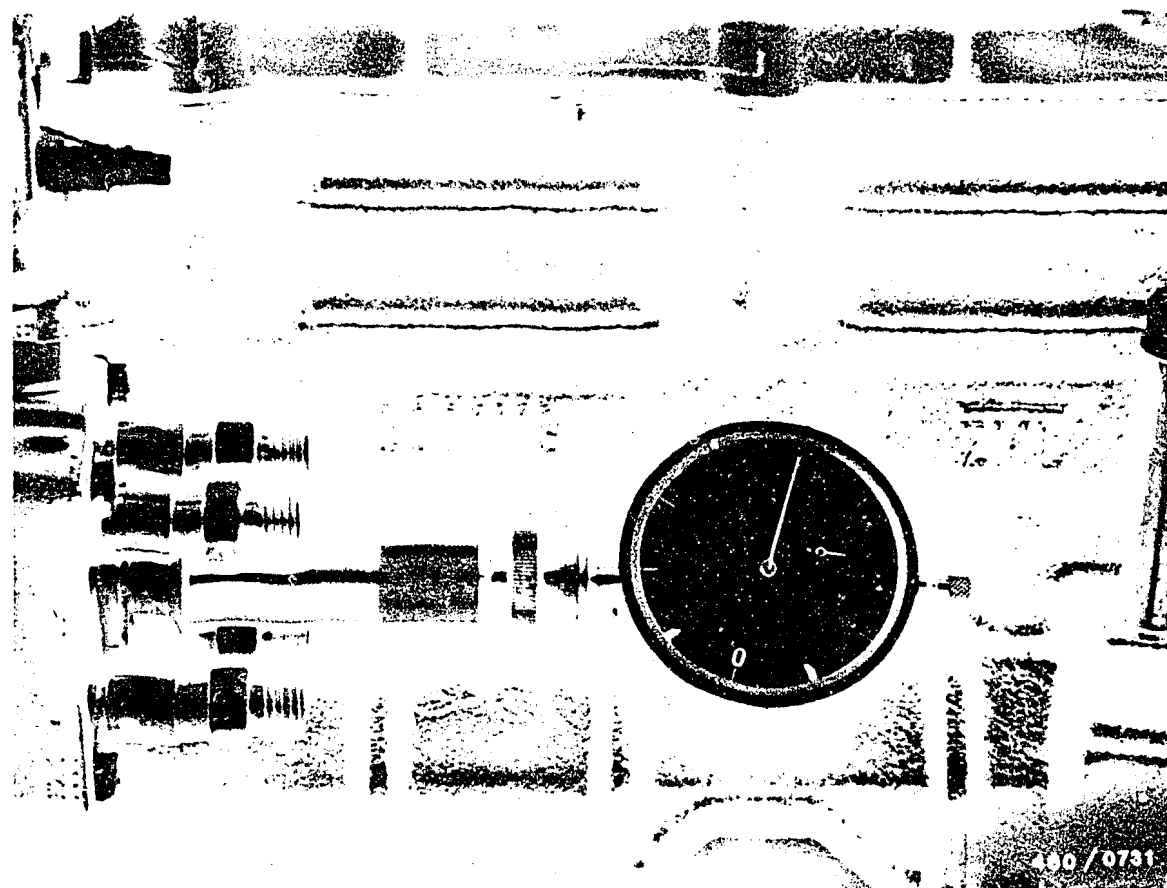
#### COORDINATING THE FUEL-INJECTION PUMP AND ENGINE

Remove the cylinder-head cover.

Turn the crankshaft to TDC of cylinder 1 (on timing gear side).

The marking on the control housing must be aligned with the belt-gear marking (see illustration - arrow).

When testing and adjusting start of delivery, the temperature-controlled cold-start injection advance (where present) must be at zero position.



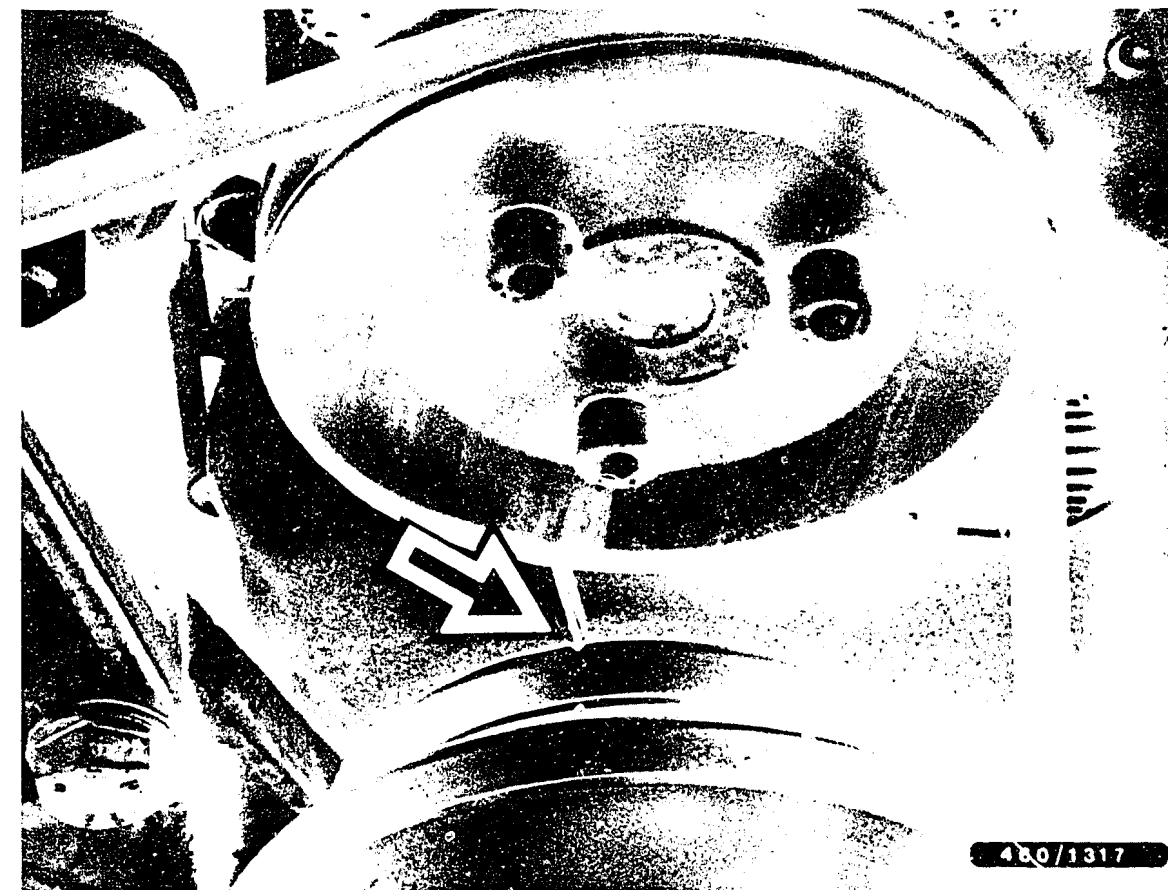
Remove injection tubing at fuel-injection pump and nozzle-holder assemblies with box wrench KDEP 1115 (prevent loosening of the delivery-valve holders by counterholding).

Remove the bleeder screw from the central screw plug (triangle-head bolt) of the distributor head.

Mount measuring device KDEP 1085 or 1126 in this hole.

Insert dial indicator (e.g. 1 687 233 011) and pre-tension about 2 mm.

Turn the engine crankshaft against the direction of engine rotation until the dial-indicator needle no longer moves.



Set dial gauge to "0".

Turn the crankshaft in the direction of engine rotation until the belt-gear marking is aligned with the TDC marking on the control housing (see illustration - arrow).

At this crankshaft position, the dial indicator at the injection pump must show, depending on the engine type, a pump-piston stroke of:

1.8 l	Turbo-Diesel	1.00...1.03 mm
2.0 l	Turbo-Diesel	0.97...0.99 mm
2.4 l	Turbo-Diesel	0.78...0.80 mm
2.5 l	Turbo-Diesel	0.88...0.90 mm

after BDC.

If necessary, correct by pivoting the fuel-injection pump.

Tighten injection-pump fastening bolts to 25 Nm.

Remove measuring device KDEP 1085 or 1126 and dial indicator.

Install the bleeder screw with a new seal ring.

Tighten fuel-injection tubing with box wrench KDEP 1115 (prevent turning of the delivery-valve holders by counterholding).

Install the cylinder-head cover.

## TESTING CHARGE-AIR PRESSURE

When working on the turbo-supercharger, note that even the smallest contamination particles can lead to the destruction of the supercharger.

For this reason, **n e v e r** operate the engine without an air filter.

To test the charge-air pressure, use pressure testing device KDJE-P 100, or a 0 ... 16 bar pressure gauge (e.g. Wika No. 4184).

The charge-air pressure can be measured while the vehicle is stationary or during driving.

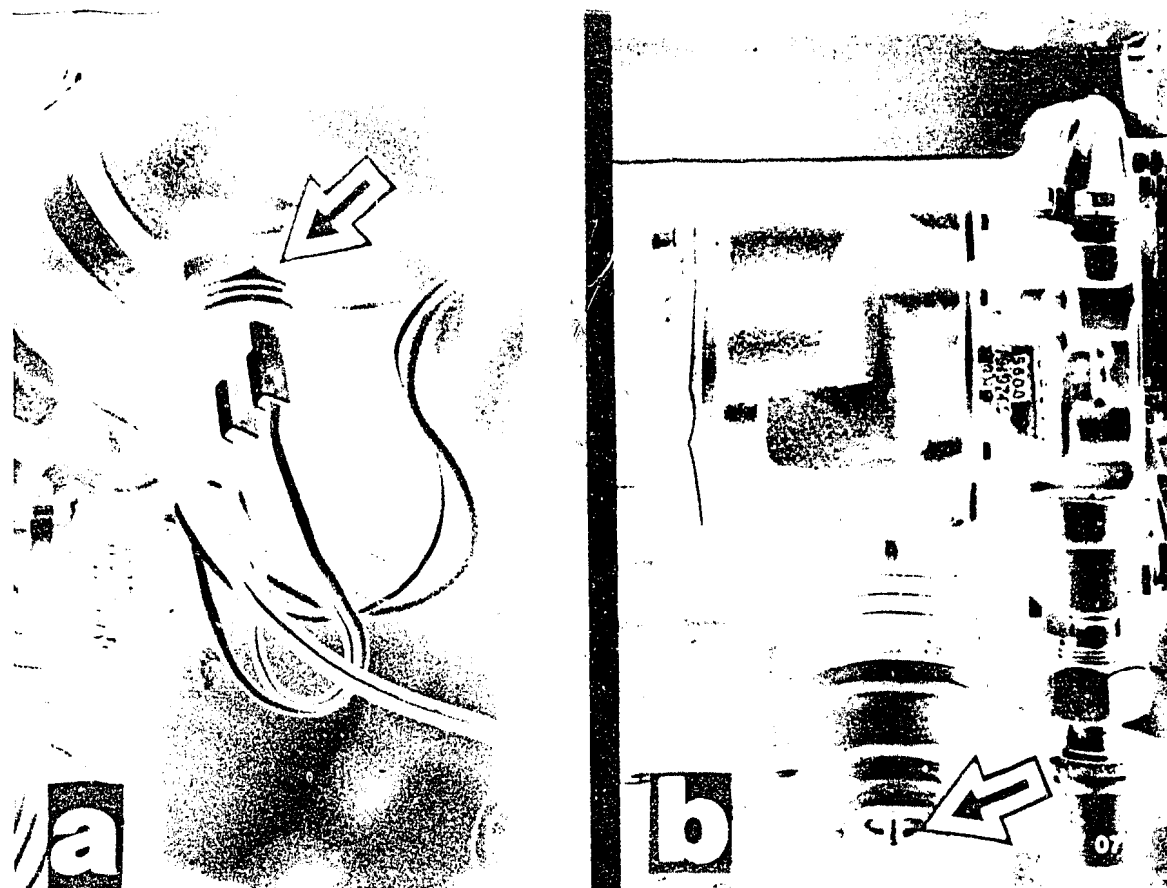
## MEASURING CHARGE-AIR PRESSURE

### N o t e :

The following are requirements for testing the exhaust turbo-supercharger:

Engine at normal operating temperature, start of delivery and nozzle-opening pressure correctly set, no leakage on either induction or exhaust side, mechanical condition of engine (valve clearance, compression) OK.

After installing a new exhaust turbo-supercharger, fill the supercharger with oil and run the engine about 1 minute in idle to ensure the proper supply of oil to the supercharger.



Installing the pressure-measuring device for charge-air pressure measurement

Remove the pressure switch on the charge-air pipe (Fig. a, arrow).

Screw in a 12 x 1.5 fitting and connect with pressure gauge using commercially-available hose.

\* Charge-air measurement with vehicle stationary without loading:

At 4000 min<sup>-1</sup> = 0.39...0.45 bar

\* Charge-air pressure measurement during driving with loading:

At highest engine speed max. 0.88 bar

Charge-air pressure excessive/insufficient (no leakage)

Adjust the charge-air-pressure control valve (Fig. b, arrow), if necessary replace the turbo-supercharger.

For production reasons:  
continued on the following  
coordinate.



SPECIAL FEATURES (continued)

\* Up to variant no. 3t2 (control unit 1) the flashing-code fault output is stimulated with the flashing-code evaluation unit KDAW 9980.  
As of variant no. 3t3 (control unit 1) the flashing-code fault output is stimulated using the pedal-position sensor.

Note:  
The control unit must be removed in order to establish the variant no. This can be avoided if the following procedure is employed:  
Effect stimulation with pedal-position sensor. If this is not possible, self-diagnosis is stimulated using the flashing-code evaluation unit KDAW 9980.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart outlines various causes/component faults. Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

NOTE:  
Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to the information given in the basic instructions, so as not to endanger people and to prevent damage to engine, trigger boxes and control units.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idle with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and the formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	* * * * * Self-diagnosis
*	* * * * * Voltage supply, control units
*	* * * * * Injected-quantity adjuster
*	* * * * * Control-collar travel sensor
*	* * * * * Electric shutoff device (ELAB)
*	* * * * * Computer monitoring (control unit 2)
	* * * * * Solenoid-operated valve, start of injection
	* * * * * Electropneumatic switching valve (EGR)
	* * * * * Nozzle-holder assembly with needle-motion sensor (NBF)
	* * * * * Interface
	* * * * * Computer communication
	* * * * * Engine-speed sensor
*	* * * * * Engine-speed sensor and NBF
*	* * * * * Tank empty, tank ventilation
*	* * * * * Injection sequence not firing sequence

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1. Diagnosis lamp
2. Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3. Engine hunts when idling
4. Harsh idling with warm engine
5. High fuel consumption in conjunction with inadequate engine output and formation of smoke
6. Unsatisfactory performance
7. Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8. Hard engine running

Cause (component fault)

*	*	*	*	*	*	*	*	Self-diagnosis
			*					Inlet-union screw, fuel return line
*			*					Air in fuel system
*								Paraffin separation
*				*				Leakage in fuel lines
*								Supply lines clogged
*			*	*		*	*	Injection nozzle
*			*	*		*		Pump/engine assignment
*								Fuel filter
*								Glow plug system
*			*	*				Engine compression
			*			*		Engine air filter
*			*	*	*			Engine management
					*	*		Timing device
				*				Turbocharger
				*				Charge-air-pressure sensor
				*				Boost-pressure control
*								Fuel heating
					*			GR valve

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

- 9. Diagnosis lamp
- 10. Engine missing when driving
  - 11. Engine cuts out automatically
  - 12. Engine runs at constant speed
  - 13. Engine doesn't run up when cold
  - 14. High idle or rough engine running at high speed
  - 15. Black fumes in full-load range
  - 16. Cloud of fumes in full-load range

Cause (component fault)

*	*	*	*	*	*	*	Self-diagnosis
			*				Pedal-position sensor and brake/brake safety switch
		*					Injected-quantity adjuster
		*					Control-collar travel sensor
		*					Computer monitoring (control unit 1)
		*					Engine-speed sensor and needle-motion sensor
*	*		*			*	Tank empty, tank ventilation
			*			*	Injection sequence not firing sequence
*			*			*	Inlet-union screw, fuel return line
*			*			*	Air in fuel system
			*				Paraffin separation
*							Leakage in fuel lines
*			*			*	Supply lines clogged

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
Cause (component fault)	
*	* Self-diagnosis
	* Pump/engine assignment
	* Fuel filter
	* Engine compression
	* Safety switch, pedal-position sensor
*	Fuel heating
*	Electric shutoff device (ELAB)
	* Engine-speed sensor

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

17.	Diagnosis lamp
18.	High idle
19.	No road-speed control (FGR) operation possible
20.	No EGR function
21.	No idle speed increase
Cause (component fault)	
*	* Self-diagnosis
	* Computer monitoring
	* Solenoid-operated valve, start of injection
	* Electropneumatic switching valve (EGR)
	* Nozzle-holder assembly with needle-motion sensor
*	* Engine-speed sensor
*	* Speed-signal sensor
	* Switch, coupling or transmission neutral switch and/or brake/brake safety switch
	* Air temperature sensor
	* Engine temperature sensor
	* A/C switch
	* Operating element, road-speed control
	* Interface
	* Engine-speed signal
	* Electropneumatic switching valve (automatic, RSC)



## SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Temp. sensor Engine Op.circ./sh. to pos. Short to ground	3	1	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature sensor, resistance: at 15...30°C at approx. 80°C	(CU 1) 23,35	1300...3600 $\Omega$ 250... 390 $\Omega$
Speed-sig. sens. Incorrect/no signal	9	7	<u>Correct speed display</u> : engine plug term. 14-ground Test lead for open-circuit: engine plug term. 14-plug Instrument cluster term. 26 and engine plug term. 14-plug Control unit 1 term. 9  <u>No speed display</u> : test speed-signal sensor.  Test lead for open-circuit: speed-signal sensor - instrument cluster	(CU1) 9	> 4,5 V  9 pointer deflections/wheel revolution
Road-sp. cont. - Operating element Op.circ./sh. to pos. Short to ground	10	3	Switch through FGR operating element positions: neutral N, reactivate RA, set (accelerate) S(a), set (decelerate) S(d), off. Measure voltages at term. 1 and term. 4.  Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Road-speed control (road-speed cont.) = FGR	(CU1) 26,35	N: 3,18...3,69 V RA: 1,43...1,94 V S(a): 0,57...1,08 V S(d): 2,35...2,86 V Off: 3,96...4,47 V
Interface Comp. communication Faulty	11	5	Test leads for open-circuit, kinking and crushing. Loose contacts at plug connections.  <u>Control unit 1 computer monitoring</u> : fault code/flash code may not be indicated. If engine start not possible, control unit 1 defective.	(CU 1) 14,15 (CU 2) 9,12	

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Interface Comp. communication Faulty	11	5	Control unit 2 computer monitoring: fault-memory interrogation not possible. Voltage at plug connection - solenoid valve, start of injection term. 1 with respect to ground with ignition on. If no voltage applied, control unit 2 defective.		12 V
Air-temp. sensor Op. circ./short to positive  Short to ground	12	6	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance: at 15...30°C at approx. 80°C		1300...3600 Ω 250... 390 Ω
Eng.-speed sensor Op.circ/grnd short  Signal error	129	14*	Test leads for open-circuit and short-circuit to ground. Resistance, engine-speed sensor at approx. 20°C:  Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms. Test leads for open-circuit (op. circ.) and short-circuit to ground.  Resistance, engine-speed sensor at approx. 20°C: Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms.	(CU1) 31,35  (CU1) 31,35	900...1100 Ω   900...1100 Ω Signal pattern, see Coordinate: 20
Fuel temperature sensor Op.circ./sh. to pos.  Short to ground	130	4	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301.  Test temperature sensor and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance at 15...30°C: at 50...70°C:	(CU1) 24,35	1200...4000 Ω 300...1200 Ω

\* Serious fault, diagnosis lamp permanently lit

SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Pedal-p. sens. Potentiometer Signal too high  Signal too low  Comparison not O.K.	132	2	<p>Pedal-position-sensor resistance term. 2 and term. 4 as well as term. 1 and term. 4.</p> <p>Accelerator pedal is in idle position.</p> <p>Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. <u>Observe installation instructions for pedal-position sensor.</u></p> <p>Voltage at pedal-position sensor term. 1 and term. 4.</p> <p>Move accelerator pedal from idle to full-throttle position;</p> <p>Idle position:</p> <p>Full-throttle position:</p> <p><u>Comparison not O.K.</u></p> <p>Connect multimeter (A) to plug, pedal-position sensor term. 1 and term. 4, multimeter (B) to plug, pedal-position sensor term. 4 and term. 5. Multimeter A:</p> <p>Multimeter B:</p> <p>Move accelerator pedal from idle and full-throttle position. Step response (B) must result at set value (A).</p> <p>Test lead for open-circuit.</p> <p><u>Dynamic pedal-position-sensor monitoring:</u></p> <p>No fault indication. High idle, however reaction to accelerator-pedal movement taken place.</p> <p>Eliminate stiffness in accelerator-pedal actuator, check installation position of pedal-position sensor.</p>	<p>(CU1) 10,13, 17</p> <p>(CU1) 12</p>	<p>800...1400 Ω 800...4110 Ω</p> <p>0,23...0,50 V 2,79...4,60 V</p> <p>0,56... 1,0 V 0... 5,5 V</p>

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Ch.-air-pr. sen. Signal too high Signal too low	133	8	Voltage supply term. 1 (+) and term. 3 Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  Measure voltage with connected charge-air-pressure sensor, term. 2 (+) and term. 3.	(CU1) 28,34, 35	4.5...5.5 V  Characteristic curve, see Coord.: 20
Con.-col.tvl.sen. Signal too high Signal too low	134	12	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test voltage supply, socket 2 (+) and socket 3.  Measure resistance: sockets 2 and 3 as well as sockets 1 and 3  Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  <u>Comparison not O.K.</u> Test prerequisites: engine-speed sensor, needle-motion sensor, computer communication interface O.K.  Test leads for open-circuit (see above). Visually inspect injected-quantity adjuster (safety instructions must be heeded).	(CU1) 6,10,29	4.5...5.5 V  1,0...3,0 k $\Omega$ 0,5...2,0 k $\Omega$
Supercharger Closed loop Faulty	135	9	Test pressure transformer: at 0...120°C Test supply voltage:  Test leads for open-circuit/contact resistance: Test routing of tubing (fuel-injection tubing), air filter for venting to atmosphere.  Test vacuum, hoses (visual inspection): Test function of bypass flap with Mityvac pump. Mechanical noise at turbocharger?	(CU 1) 1,25	4,5...8,0 $\Omega$ 12 V  > 500 mbar

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Inj.-qty.adjust. Closed loop Faulty	136	10*	Test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test contact resistance term. 4 and 7 - ground.  Measure resistance, injected-quantity adjuster, term. 4 and 7. Test lead open-circuit, contact resistance, term. 4 and term. 7.	(CU2) 1,21	0,4... 0,7 $\Omega$
Needle-motion sensor Signal too high  Signal too low	142	11*	Measure resistance, needle-motion sensor (approx. 20°...80°C) Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Test contact resistance, terminal posts, needle-motion sensor - ground.	(CU1) 1,20	90... 135 $\Omega$
Start of inj. Closed-loop control Faulty	144	15	Measure resistance, solenoid valve: Test solenoid valve and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Remove fuel-injection pump and test both supply pump pressure and timing-device profile.	(CU2) 1,2	14,3...17,3 $\Omega$
Interface Engine-speed signal Faulty	145	—	Test leads for open-circuit.	(CU 1) 8 (CU 2) 6	
Brake/brake safety switch Comparison not O.K.	146	—	Brake/brake safety switch (br./br. safety switch) Connect a multimeter to each circuit. Press brake pedal several times. Step response: Test voltage supply:  Test leads for open-circuit and contact resistance.	(CU 1) 5,11	infinity $\Omega$ to approx. 0 $\Omega$ 11,5...14,5 V

\* Serious fault, diagnosis lamp continuously lit

TEST SPECIFICATIONS

Component/Function Set values

Idle speed (engine at operating temp., approx. 80° C):

	Vehicle not moving	Driving speed (>2 km/h)
Manual gear shift	750 min -1	820 min -1
Auto. transmission	750 min -1	750 min -1
A/C on	865 min -1	865 min -1

Engine cold 750...1045 min -1

Nozzle opening pressure: 150 + 8 bar

Pump/engine assignment:

Setting:  
\* Engine setting: Cylinder 1 at TDC  
\* Pump setting 1.05 mm after BDC

Check value:  
\* Engine setting: Cylinder 1 at TDC  
\* Pump setting: 1.03 - 1.07 mm after BDC

Compression: 25...30 bar

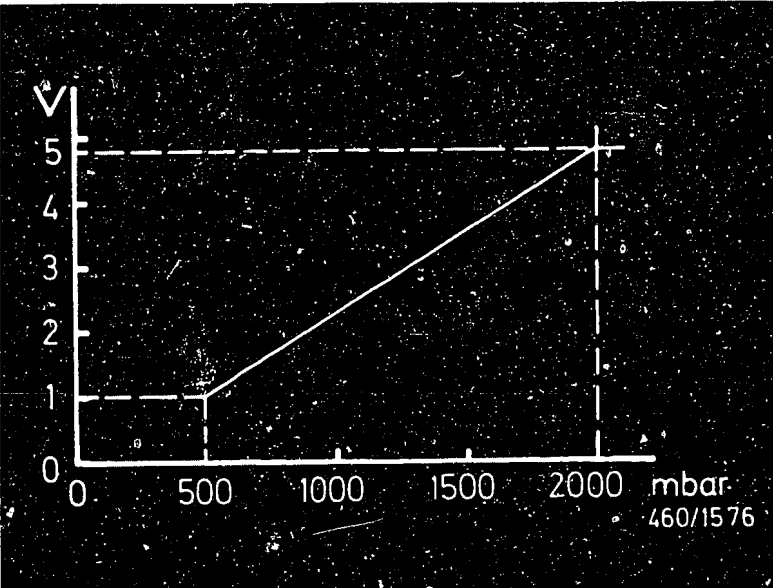
Max. cylinder deviation: 5 bar

Filter test; max. permissible difference in pressure: 0.3 bar

Pressure loss: max. perm. 25 %

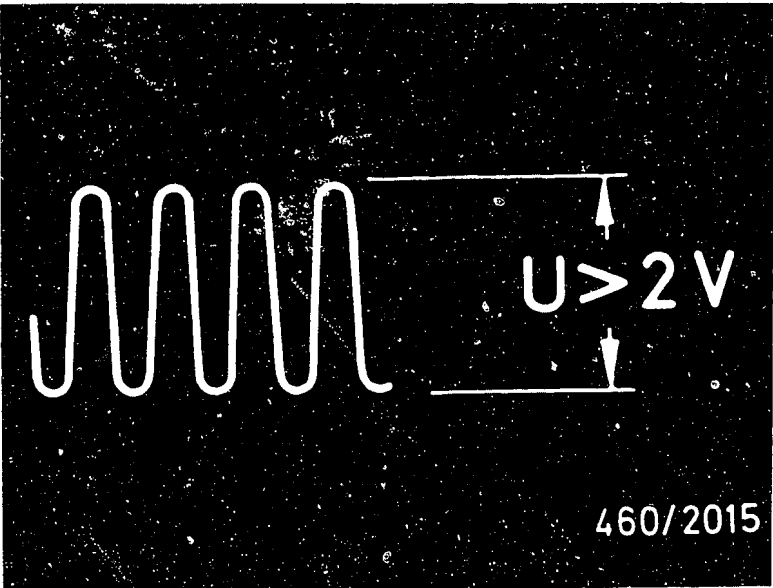
Vacuum, vacuum pump >500 mbar

Electropneum. switching valve (Resistance, EGR and RSC) 27...33 Ω



Charac. curve, charge-air-pres. sens.

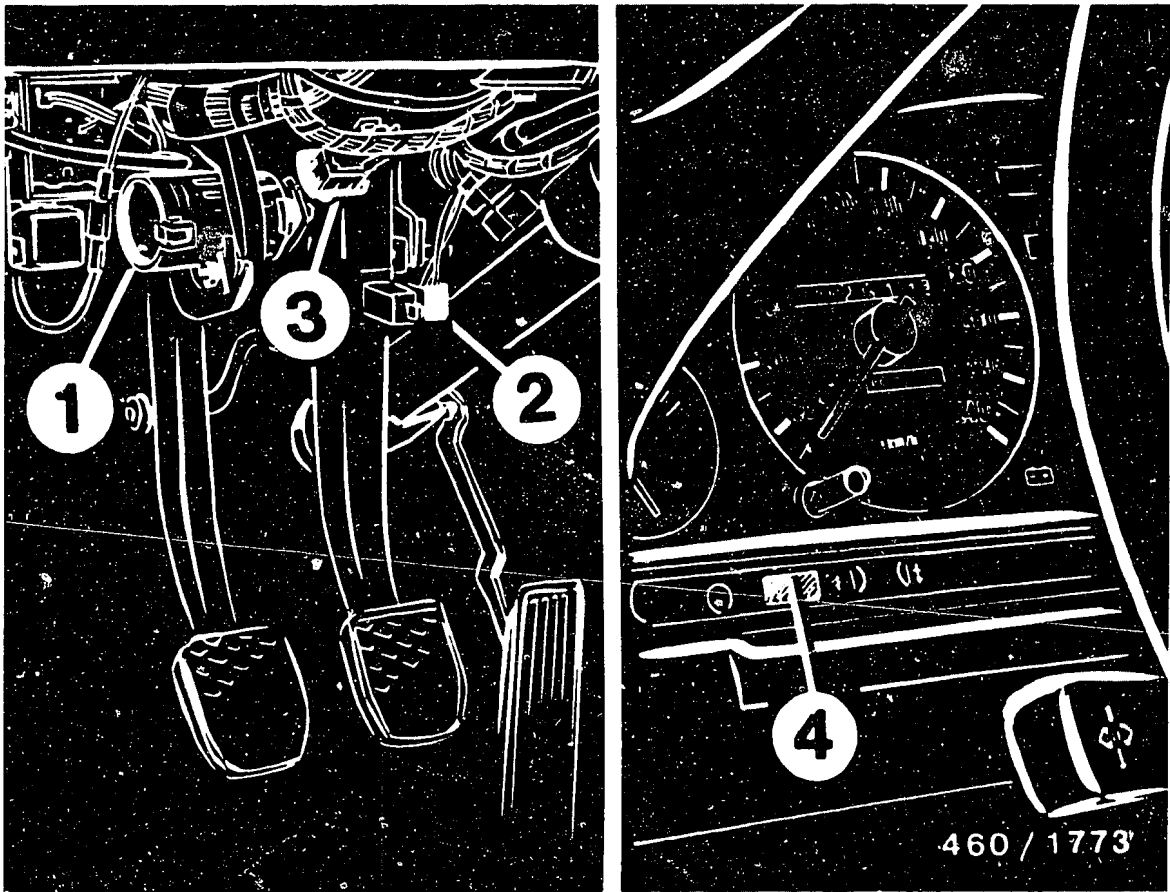
Signal pattern, engine-speed sensor



TEST SPECIFICATIONS (CONTINUED)

Tightening torques

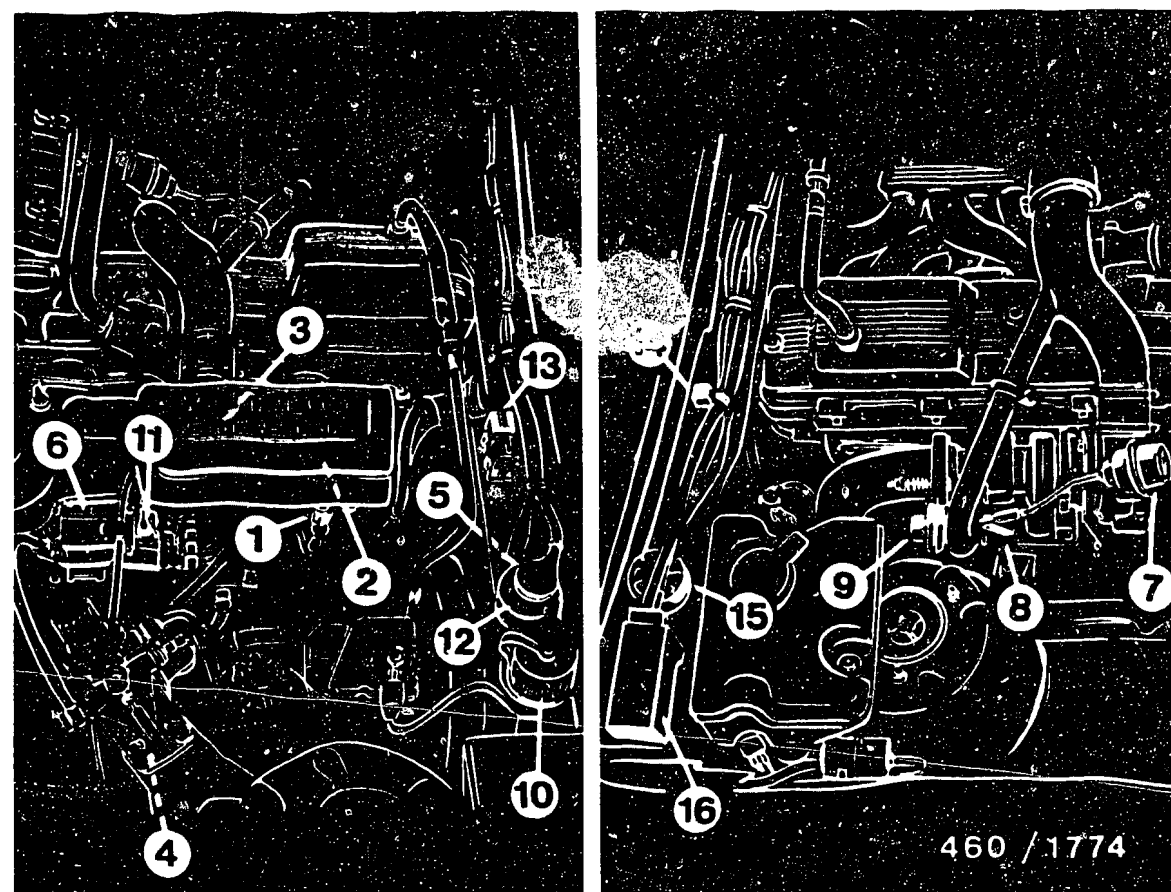
Fuel lines	25 Nm
Fastening screws, injection pump	20 Nm
Fastening screws, nozzle-holder assembly	40...45 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Cylinder-head-cover screws	7.5 Nm
Nut, injection-pump drive gear	45...50 Nm
Nut, camshaft gear	65...70 Nm
Tensioning-wheel mounting on engine (nut and bolt)	20...24 Nm
Toothed-belt pulley of jack shaft	55...65 Nm
V-belt pulley/vibration damper	22...24 Nm
Tensioning torque for tensioning- roller mounting (new toothed belt)	45...50 Nm
Tightening torque for tensioning- roller mounting (toothed-belt already run > 16 000 km)	30...35 Nm
Bleeder screw/thermostat housing	6...10 Nm



- 1 = Pedal-position sensor
- 2 = Brake/brake safety switch
- 3 = Switch, coupling
- 4 = Diagnosis lamp (in conjunction with indicator,  
water-level sensor)

INSTALLATION POSITION OF COMPONENTS

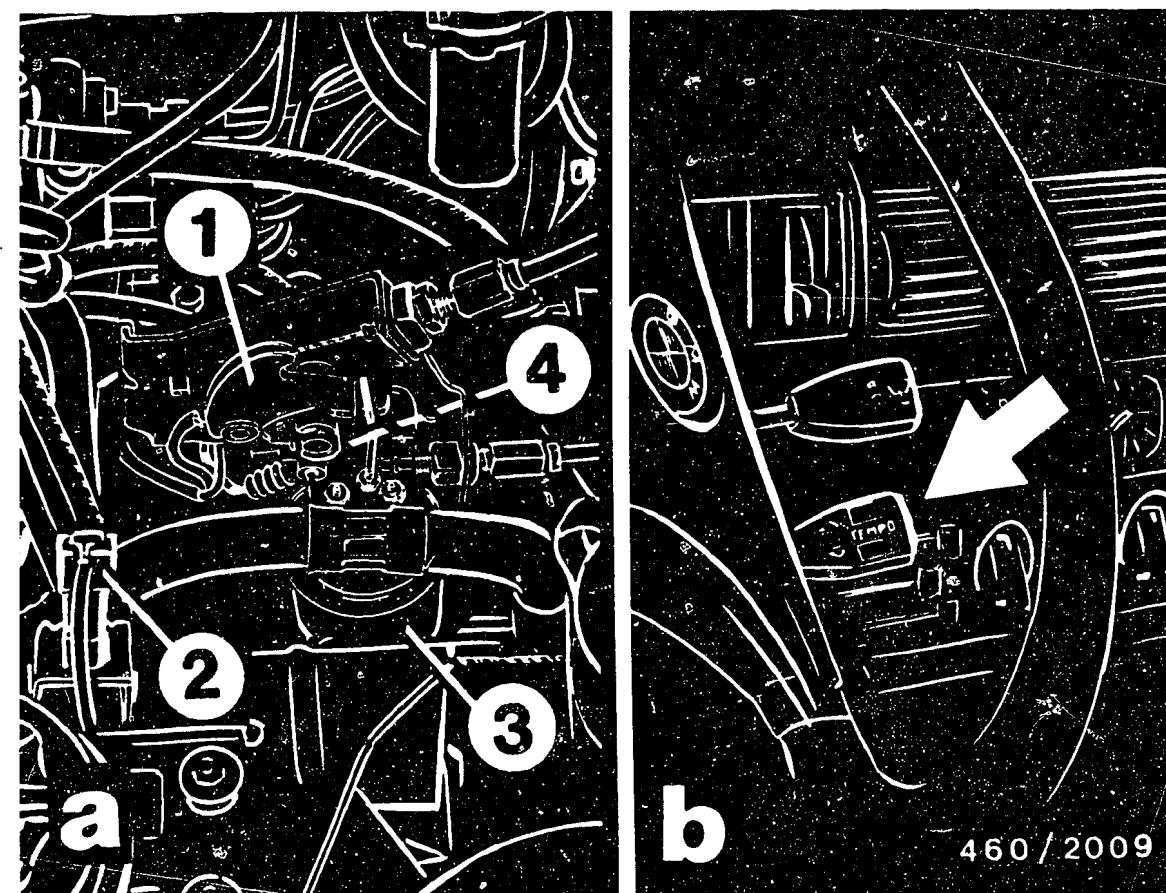
The road-speed pickup is attached to the differential housing.  
The control units are installed in the glove compartment.  
The electropneumatic switching valve is installed in the transmission; the transmission neutral switch is installed in the gear-shift console.



- 1 = Air temperature sensor
- 2 = Engine temperature sensor
- 3 = Nozzle-holder assembly with NMS (cyl. 4)
- 4 = Charge-air-pressure sensor
- 5 = Engine-speed sensor
- 6 = Fuel-injection pump
- 7 = Control box (LDR)
- 8 = Bypass-flap actuator
- 9 = EGR valve
- 10 = Diagnosis plug
- 11 = Electric shutoff device
- 12 = Engine plug
- 13 = Reversed-polarity protection relay
- 14 = Electropneumatic switching valve (EGR)
- 15 = Electropneumatic pressure transformer (LDR)
- 16 = Glow-duration unit

#### INSTALLATION POSITION OF COMPONENTS (continued)

The solenoid-operated valve for start of injection and the fuel temperature sensor are installed in the fuel-injection pump.



#### Vehicles with automatic transmission (Fig. a)

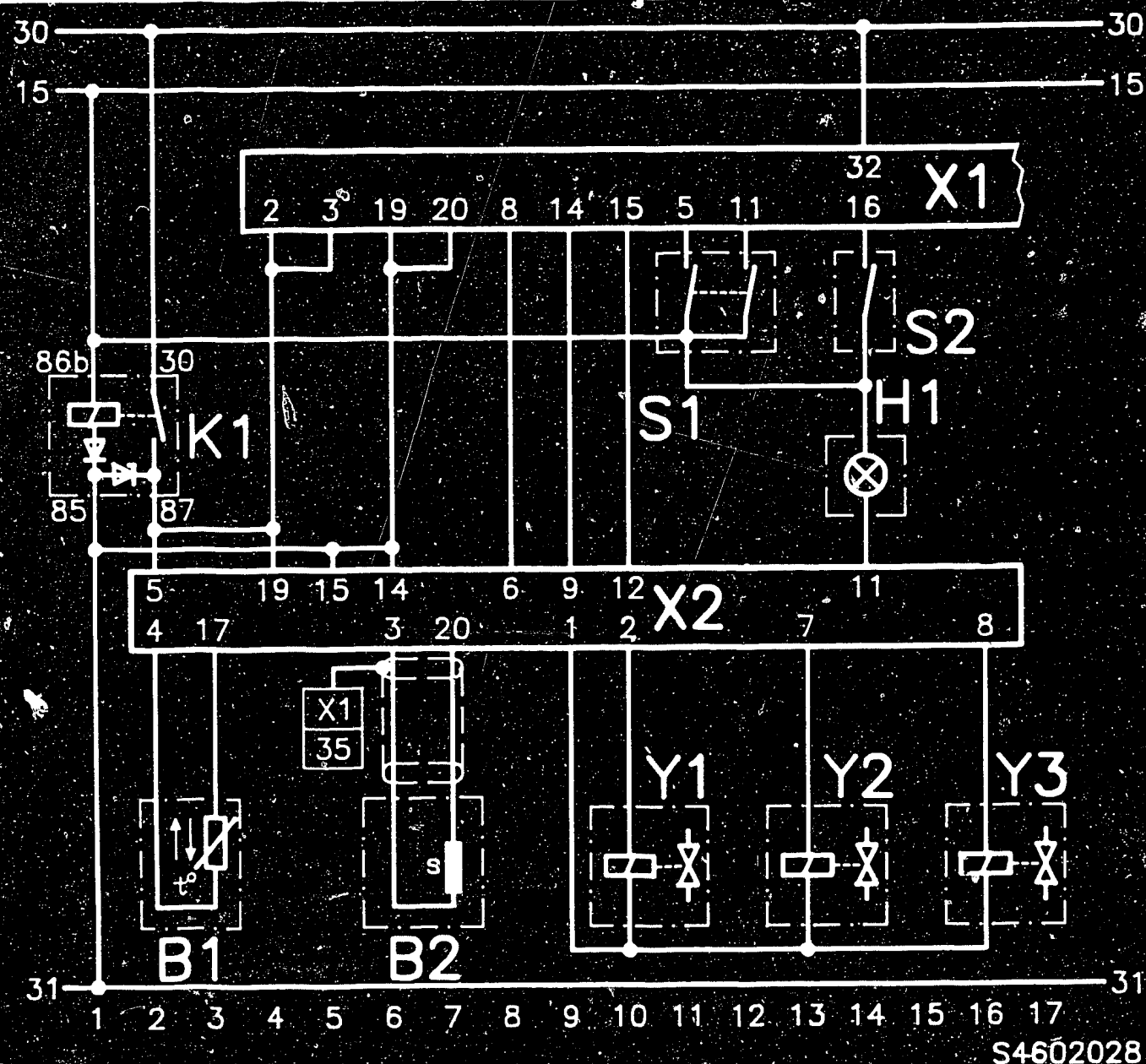
- 1 = Automatic transmission control
- 2 = Electropneumatic switching valve (RSC)
- 3 = Control box (RSC)
- 4 = Transmission indicator (not visible in picture)

The electropneumatic switching valve (downshift block) is installed in the transmission; the transmission neutral switch is installed in the gear-shift console.

Operating element, road-speed control  
(Picture b, arrow)

#### INSTALLATION POSITION OF COMPONENTS (continued)



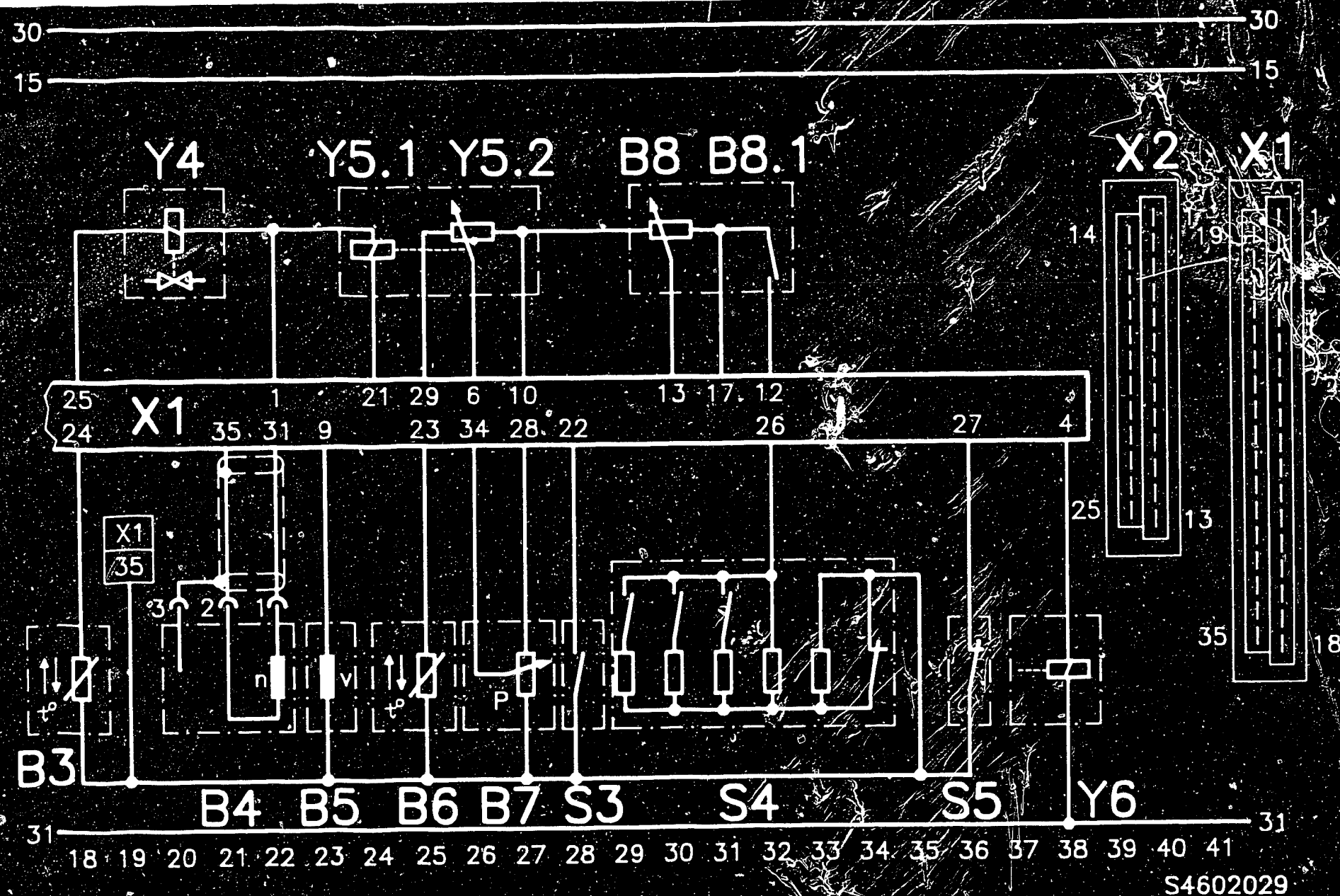


# ELECTRICAL TERMINAL DIAGRAM

B1 = Air temperature sensor  
 B2 = Needle-motion sensor  
 H1 = Diagnosis lamp  
 K1 = Reversed-polarity protection relay  
 S1 = Brake/brake safety switch  
 S2 = A/C switch  
 X1 = Control unit 1

X2 = Control unit 2  
 X3 = Diagnosis socket  
 Y1 = Solenoid-operated valve, start of injection  
 Y2 = Electropneumatic switching valve (EGR)  
 Y3\* = Electropneumatic switching valve

\* Only for vehicles with automatic transmission



# ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

B3 = Fuel temperature sensor  
 B4 = Engine-speed sensor  
 B5 = Speed-signal sensor  
       (speedometer signal)  
 B6 = Engine temperature sensor  
 B7 = Charge-air-pressure sensor  
 B8 = Pedal-position sensor  
 B8.1 = Safety switch  
 S3 \* = Transmission indicator  
 S4 = Operating element, road-speed control

S5 = Switch, coupling (for vehicles with  
       automatic transmission, transmission  
       neutral switch)  
 X1 = Control unit 1  
 X2 = Control unit 2  
 Y4 = Electropneumatic pressure transformer  
       (boost-pressure control)  
 Y5.1 = Injected-quantity adjuster  
 Y5.2 = Control-collar travel sensor  
 Y6 = Electric shutoff device

(\* Only for vehicles with automatic transmission)

BOSCH system : Electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Make of vehicle : BMW

Basic microcard : FZD-00..

These brief instructions, valid at the time of publication, apply to the following BMW model:

524 td  
with electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Engine: M 21 D 24 WA, 85 kW  
A, 03.87 ->

TABLE OF CONTENTS

Section	Coordinates
Special features.....	02
Structure, usage.....	02
Safety and precautionary measures.....	03
Trouble-shooting chart.....	04
Trouble-shooting.....	07
Self-diagnosis via flashing-code evaluation.....	08
Self-diagnosis test table.....	09
Test specifications.....	23
Electrical terminal diagram.....	25
Installation position of components.....	27

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults. Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION:  
Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

Always observe these measures in order to prevent damage to the engine, control units and peripheral components of the EDC.

1. For testing the compression, disconnect the lead from the ELAB (electric shutoff device).
2. In the case of nozzle-holder assemblies with inductive start-of-injection sensor, the after-sales service workshop is permitted to adjust only the nozzle-opening pressure.
3. Never start the engine when the battery terminals are not firmly connected.
4. Do not use a fast charger for starting the engine.  
Starting aid may be provided using only a second 12 V battery and jump leads.
5. Disconnect the battery from the vehicle electrical system before boost charging.
6. Never disconnect the battery from the vehicle electrical system when the engine is running.
7. Never disconnect or connect control-unit plugs when the ignition is switched on.
8. Remove control units when the temperature exceeds + 80° C (paint-drying installation).
9. When welding on the vehicle (electric spot welding), remove control units.
10. The protective hose at the cable connection to the injection pump must be replaced after work on the plug-in connection.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Diagnostic lamp lights
2. Starting motor operates, but engine fails to start or starts only with difficulty (when warm or cold)
3. Engine hunts when idling
4. Rough idling when engine is warm
5. Fuel consumption high, maximum engine power not reached, and smoke formation
6. Unsatisfactory performance
7. Black smoke in full-load range, engine running rough; possibly lack of power
8. Engine running rough

								Cause (component fault)
*								Self-diagnosis
	*							Voltage supply, control units
	*							Delivery controller
	*							Spool-travel sensor
	*							ELAB
	*			*	*			Computer monitoring
				*	*			Solenoid-op. valve (start of injection)
					*			Electropneumatic switch-over valve (EGR)
				*				Nozzle-holder assembly with needle-movement sensor (NBF)
				*				Computer interface
	*				*			Engine-speed sensor
*								Engine-speed sensor and NBF
*								Tank empty, tank vent
*	*			*				Injection sequence, not firing sequence
	*							Inlet-union screw, fuel return
*	*							Air in fuel system
								Paraffin separation
			*					Fuel lines leaking
								Supply lines clogged
		*		*	*			Injection nozzle
	*	*		*				Coordination, pump - engine (inj.timing)
*								Fuel filter
*								Pre-heating system
*	*	*						Engine compression
		*						Engine air filter
		*						Engine timing

TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

9.	Engine misfiring during vehicle operation
10.	Engine cuts out of its own accord
11.	Engine running at constant engine speed
12.	Engine will not rev up when cold
13.	High idle and engine running rough at high engine speed
14.	Black smoke in full-load range
15.	Fog-like smoke in full-load range (white)
	Cause (component fault)
*	Accelerator-pedal sensor
*	Delivery controller
*	Spool-travel sensor
*	Computer monitoring
*	Engine-speed sensor and NBF
*	Tank empty, tank ventilation
*	Injection sequence not firing sequence
*	Inlet-union screw, fuel return
*	Air in fuel system
	Paraffin separation
*	Fuel lines leaking
*	Supply lines clogged
	Coordination, pump - eng. (injec. timing)
	Fuel filter
	Engine compression
*	Safety switch, accelerator-pedal sensor
*	Fuel heater

TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

16.	Severe bucking, no idle increase during vehicle operation (manually shifted transmission)
17.	Faults are not stored by self-diagnosis
18.	Exhaust-gas recirculation not functioning
19.	No low-idle-speed increase
20.	Unsatisfactory performance
21.	Black smoke in full-load range, engine running rough; possibly lack of power
	Cause (component fault)
*	Computer monitoring
*	Solenoid-op. valve (start of injection)
*	Electropneumatic switch-over valve (EGR)
*	Nozzle-holder assembly with NBF
*	Engine-speed sensor
*	Road-speed sensor
*	Switch, clutch or brake
*	Temperature sensor (air)
*	Temperature sensor (coolant)
	Switch, air conditioner
	Turbo-supercharger
	EGR valve
	Timing device

## TROUBLE-SHOOTING

### How to use the self-diagnosis

Trouble-shooting (testing) must always begin with self-diagnosis.

In position 2 of the key-operated switch, the diagnostic lamp lights up for approx. 5 seconds (lamp test).

If the diagnostic lamp does not light up after actuation of the key-operated switch, test the self-diagnosis.

Always note down the flashing-code output.

If the voltage supply for the control units is interrupted, the faults stored are cleared.

If a faulty operational path is indicated, pay particular attention to the following:

- \* loose contacts at multiple cable connections
- \* dirty, pushed-back or corroded plug contacts
- \* breaks in lines at kinked or pinched locations.

Test instruction:

before disconnecting or connecting the control-unit plug, switch off the ignition.

## SELF-DIAGNOSIS VIA EVALUATION OF FLASHING CODE

An integrated self-diagnosis system makes it possible to locate a faulty component or line path by means of a flashing code. The indicator lamp is located in the instrument panel.

Using the flashing-code evaluation unit KDAW 9980, the diagnostic program is activated by briefly connecting socket 15 (20-pin diagnostic plug) to ground.

The flashing-code output begins with the fault which was stored first of all. The faults are output one after the other. The program returns to the beginning once the last fault has been output (annular slide valve).

### Evaluating the flashing code

1. Switch on ignition.
2. The self-diagnosis must be stimulated for at least 4 seconds.
3. Flashing code is indicated.
4. Repeat stimulation:
  - a. if there is no further fault, the same fault is indicated again
  - b. if there are further faults, these are indicated after each renewed stimulation. Once all the stored faults have been output, the first fault code stored is indicated (annular slide valve).

### Clearing the flashing code

1. Position key-operated switch to position 2.
2. Actuate brake pedal and simultaneously stimulate the self-diagnosis.
3. Call up the self-diagnosis through renewed stimulation.
4. If the indicator lamp does not light, the fault memory has been cleared.

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions /Test conditions	Terminals	Set values
1	Temperature sensor (coolant)	Test resistance at component. +15...+30°C: Approx. 80°C:  Test measuring voltage (control unit) at disconnected cable connector.		1300...3600 $\Omega$ 250...390 $\Omega$  approx. 5 V
2	Accelerator-pedal sensor	Conduct tests at component.  * Internal resistance  * Supply voltage  * Voltage signal:       -idle position -full-load position  * Safety switch:       -idle position -full-load position	2 - 4  2 - 4 (+) (-) 1 - 4 1 - 4  2 - 5 2 - 5	800...1400 $\Omega$  4.5...5.5 V 0.23...0.50 V 2.79...5.0 V  > 1 M $\Omega$ 600...1400 $\Omega$
4	Temperature sensor (fuel)	Conduct tests at 7-pin cable connector of EDC distributor-type fuel-injection pump with aid of test adapter KDEP 1165 and adapter leads KDEP 1165/100 and -/101.  * Short circuit to ground Connect adapter to cable connector to injection pump  * Short circuit Connect adapter to cable connector to injection pump  * Internal resistance at 15...30°C: (Connect adapter to cable connector to injection pump)  * Measuring voltage (control unit): (Connect adapter to cable connector to control unit)	5-grnd. 6-grnd.  4 - 6  5 - 6  5 - 6	> 1 M $\Omega$ > 1 M $\Omega$  > 1 M $\Omega$  1200...4000 $\Omega$  4.5...5.5 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

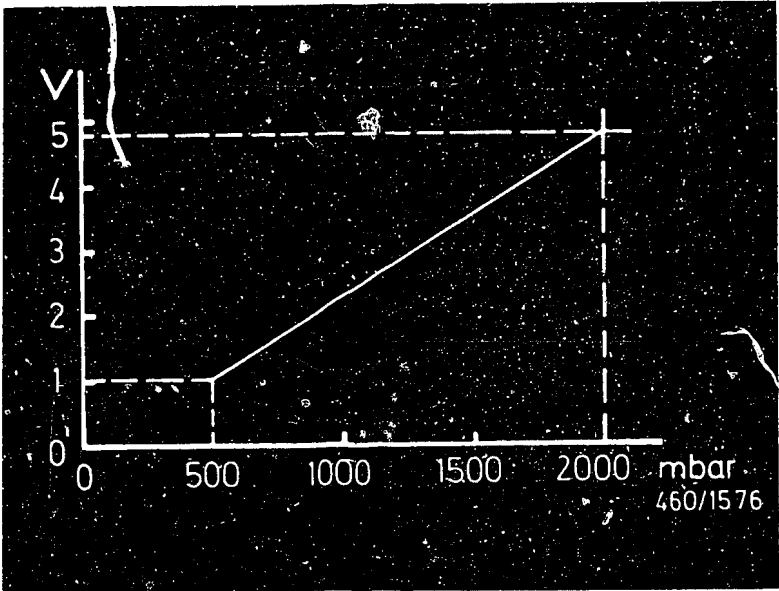
Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Termi- nals	Set values
5	Control unit, computer interface (stored)	No fault is present at the time of testing. Disconnect cable connector from control units 1 and 2.  Check leads listed below for open circuit and contact resistance:  Control unit 1      -      Control unit 2 Term. 14            to      term. 9 Term. 15            to      term. 12		Approx. 0 Ω
5	Control unit 1 Computer monitoring	Fault in the computer monitoring is present only if the engine c a n n o t be started after the flashing code has been indicated.		
(5)	Control unit 2 Computer monitoring	No indication by the indicator lamp after stimulation of the self-diagnosis.  Exhaust-gas recirculation switched off. Disconnect multiple butt connector from solenoid-operated valve (start of injection). Test measuring voltage (control unit) at multiple butt connector.		Approx. 12 V
6	Temperature sensor (air)	Test resistance at component.  15...30° C: Approx. 80° C:  Test measuring voltage (control unit) at disconnected cable connector.		1300...3600 Ω 250...390 Ω  Approx. 5 V
7	Road-speed sensor	Test requirement: correct speed indication  Measuring voltage (instrument cluster) at disconnected cable connection of pedal-position sensor (installed behind control units) <hr/> Test requirement: no speed indication  Test component for proper functioning.	10(+) - (-)	>4.5 V   9 pointer deflections/ wheel rotation



SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function Test instructions/conditions	Termi- nals	Set values
8	Charge-air pressure sensor. Test component. * Supply voltage * Voltage signal (determine barometric pressure)	1 - 3 1 - 2	4.5...5.5 V see character- istic curve
*10*	Delivery controller. Conduct test at 7-pin cable connector of EDC distributor-type fuel-injection pump with the aid of the test adapter KDEP 1165 and the adapter leads KDEP 1165/100 and /-101.  * Short circuit to ground Connect adapter to cable connector to injection pump * Internal resistance Connect adapter to cable connector to injection pump * Supply voltage Connect adapter to cable connector to control unit	4-grnd. 7-grnd.  4 -7  7-grnd.	> 1M $\Omega$ > 1M $\Omega$  0.3...1.2 $\Omega$  8.5...14.5 V

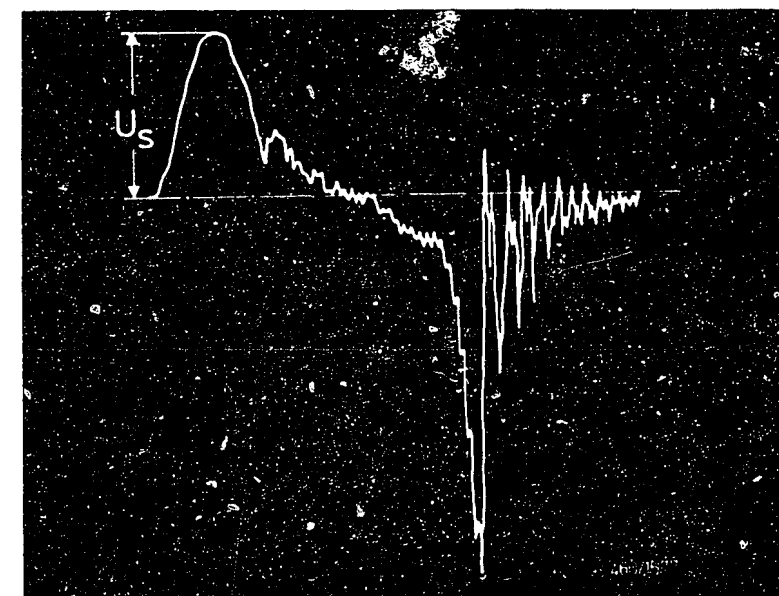
\* \* = Serious fault (occurrence results in steady light of indicator lamp during op.)



## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/ function Test instructions/conditions	Terminals	Set values
*11*	<p>Needle-movement sensor. Conduct test at cable connector of component.</p> <ul style="list-style-type: none"> <li>* Short circuit to ground</li> <li>* Internal resistance approx. 20°C approx. 80°C</li> <li>* Supply voltage <ul style="list-style-type: none"> <li>- cable connector disconnected</li> <li>- cable connector connected at approx. 80° C</li> </ul> </li> <li>* Needle-stroke signal/signal voltage (<math>U_s</math>) <ul style="list-style-type: none"> <li>- cable connector connected</li> <li>- run engine at idle speed</li> <li>- motortester, special input</li> </ul> </li> </ul>		<p>&gt; 1 M <math>\Omega</math></p> <p>90...110 <math>\Omega</math> 111...135 <math>\Omega</math></p> <p>10.0...12.0 V 1.8... 8.8 V</p> <p>see signal pattern</p> <p><math>U_s = &gt; 150</math> mV</p>

\* \* = serious fault (occurrence results in steady light of indicator lamp during op.)



SELF-DIAGNOSIS TEST TABLE (CONTINUED)

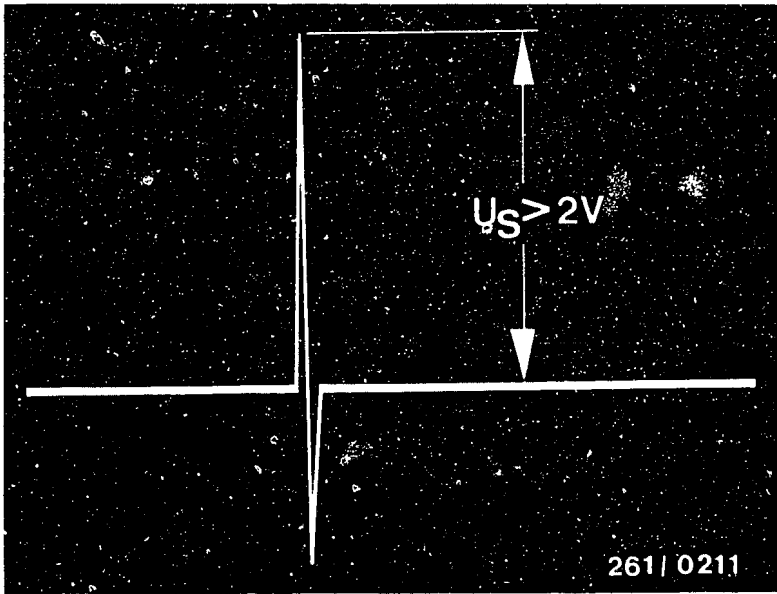
Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
*12*	Spool-travel sensor	<p>Conduct tests at 7-pin cable connector of EDC distributor-type fuel-injection pump with aid of test adapter KDEP 1165 and adapter leads KDEP 1165/100 and -/101</p> <p>* Short circuit to ground Connect adapter to cable connector to injec. pump</p> <p>* Short circuit Connect adapter to cable connector to injec. pump</p> <p>* Resistance, potentiometer path Connect adapter to cable connector to injec. pump.</p> <p>* Resistance, wiper path Connect adapter to cable connector to injec. pump.</p> <p>* Supply voltage Connect adapter to cable connector to control unit.</p> <p>* Voltage signal Connect both cable connectors to adapter. Pull apart cable connection at needle-movement sensor. Make cable connection at needle-movement sensor.</p>	<p>1-grnd. 2-grnd. 3-grnd.</p> <p>2 - 7</p> <p>2 - 3</p> <p>1 - 3</p> <p>2 - 3 (+) (-)</p> <p>1 - 3</p>	<p>&gt; 1 M <math>\Omega</math> &gt; 1 M <math>\Omega</math> &gt; 1 M <math>\Omega</math></p> <p>&gt; 1 M <math>\Omega</math></p> <p>1.0...10.0 k <math>\Omega</math></p> <p>0.5...5.0 k <math>\Omega</math></p> <p>4.5...5.5 V</p> <p>0.79...0.97 V &gt; 3.0 V</p>

\* \* = serious fault (occurrence results in steady light of indicator lamp during operation).

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/ function Test instructions/conditions	Termi- nals	Set values
*14*	Engine-speed sensor Conduct tests at multiple butt connector of component.  * Short circuit to ground  * Int. resistance at approx. 20° C  * Engine-speed signal pattern - motortester, special input - run engine at idle speed  Note: Positive signal peak must appear first.	   1 - 2   1 - 2 (+) (-)	   > 1 M Ω  900...1100 Ω  see signal pattern

\* \* = serious fault (occurrence results in steady light of ind. lamp during op.)



SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
15	Solenoid-operated valve (start of injection)	<p>Conduct tests at multiple butt connector of component.</p> <ul style="list-style-type: none"><li>* Short circuit to ground</li><li>* Internal resistance at approx. 60° C</li><li>* Test measuring voltage (control unit) at disconnected multiple butt connector.</li><li>* Actuation on/off ratio<ul style="list-style-type: none"><li>- coolant temperature approx. 80° C</li><li>- connect pockettester to connected multiple butt connector</li><li>- set dwell-angle range</li><li>- run engine at idle speed</li><li>- disconnect needle-movement sensor</li></ul></li></ul> <hr/> <ul style="list-style-type: none"><li>- connect needle-movement sensor</li></ul> <p>Test instruction: on/off ratio must change on disconnection of the needle-movement sensor or increase of the engine speed.</p>		<p>&gt; 1 M <math>\Omega</math></p> <p>13.0...22.0 <math>\Omega</math></p> <p>approx. 12V</p>

## TEST SPECIFICATIONS

Component/Function Set values

Idle speed (engine at norm. op. temp., approx. 80° C):

	Vehicle at standstill	Road speed (>2 km/h)
Manual trans.	705 min <sup>-1</sup>	865 min <sup>-1</sup>
Automatic trans.	705 min <sup>-1</sup>	705 min <sup>-1</sup>
Air-cond. control switched on	865 min <sup>-1</sup>	865 min <sup>-1</sup>
Engine cold	705...1090 min <sup>-1</sup>	

Nozzle-opening pressure 150 + 8 bar

Coordination, pump - engine (inj. timing):

Setting:

- \* Engine position: Cylinder 1 at TDC
- \* Pump position: 1.05 mm after BDC

Check value:

- \* Engine position: Cylinder 1 at TDC
- \* Pump position: 1.03 - 1.07 mm after BDC

Charge-air pressure: max. 1850 + 50 mbar at  
(charge-air pressure + atmos- full load as of 2250 min <sup>-1</sup>  
pheric pressure)

Compression: 25...30 bar

Max. diff. between cylinders: 5 bar

Filter test, max. permissible  
differential pressure: 0.3 bar

Pressure drop: max. perm. 25 %

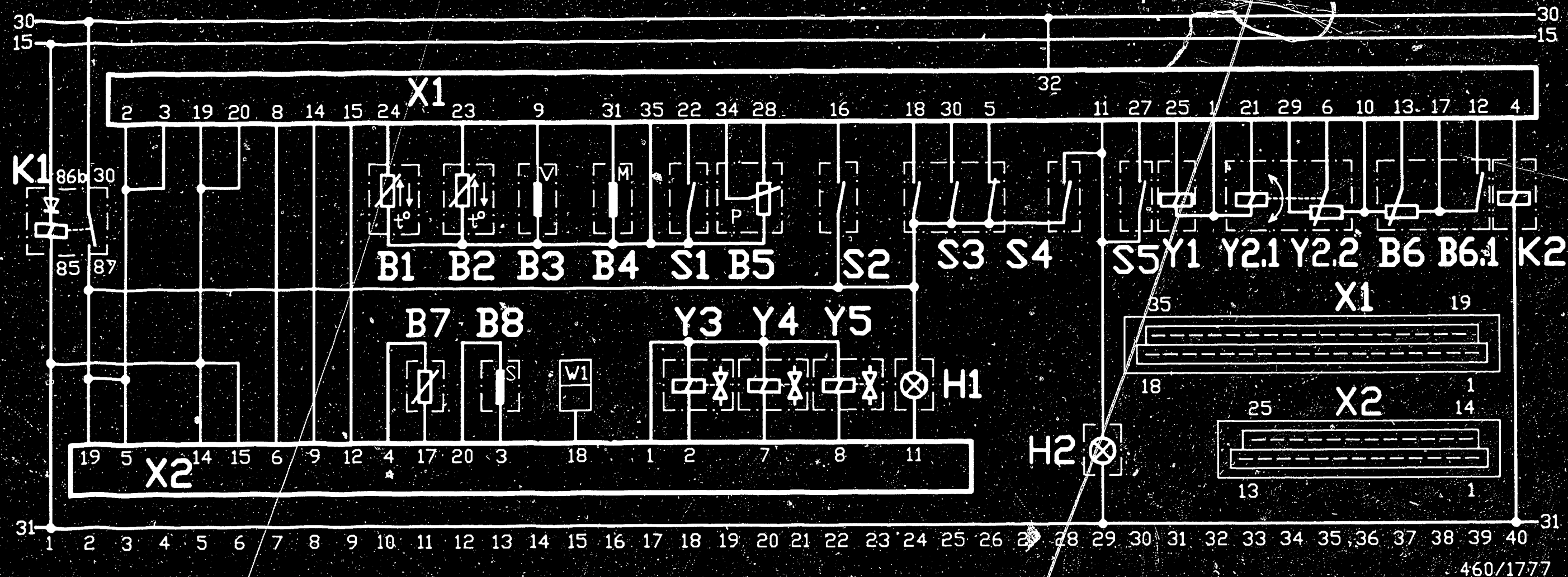
Vacuum, vacuum pump &gt;500 mbar

Electropneum. switch-over  
valve 27...33 Ω

## TEST SPECIFICATIONS (CONTINUED)

## Tightening torques

Fuel lines	25 Nm
Fastening screws, injection pump	20 Nm
Fastening screws, nozzle-holder assembly	40...45 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Cylinder-head-cover screws	7.5 Nm
Nut, injection-pump drive gear	45...50 Nm
Nut, camshaft gear	65...70 Nm
Tensioning-wheel mounting on engine (nut and bolt)	20...24 Nm
Toothed-belt pulley of jack shaft	55...65 Nm
V-belt pulley/vibration damper	22...24 Nm
Tensioning torque for tensioning- roller mounting (new toothed belt)	45...50 Nm
Tightening torque for tensioning- roller mounting (toothed-belt already run > 16 000 km)	30...35 Nm
Bleeder screw/thermostat housing	6...10 Nm

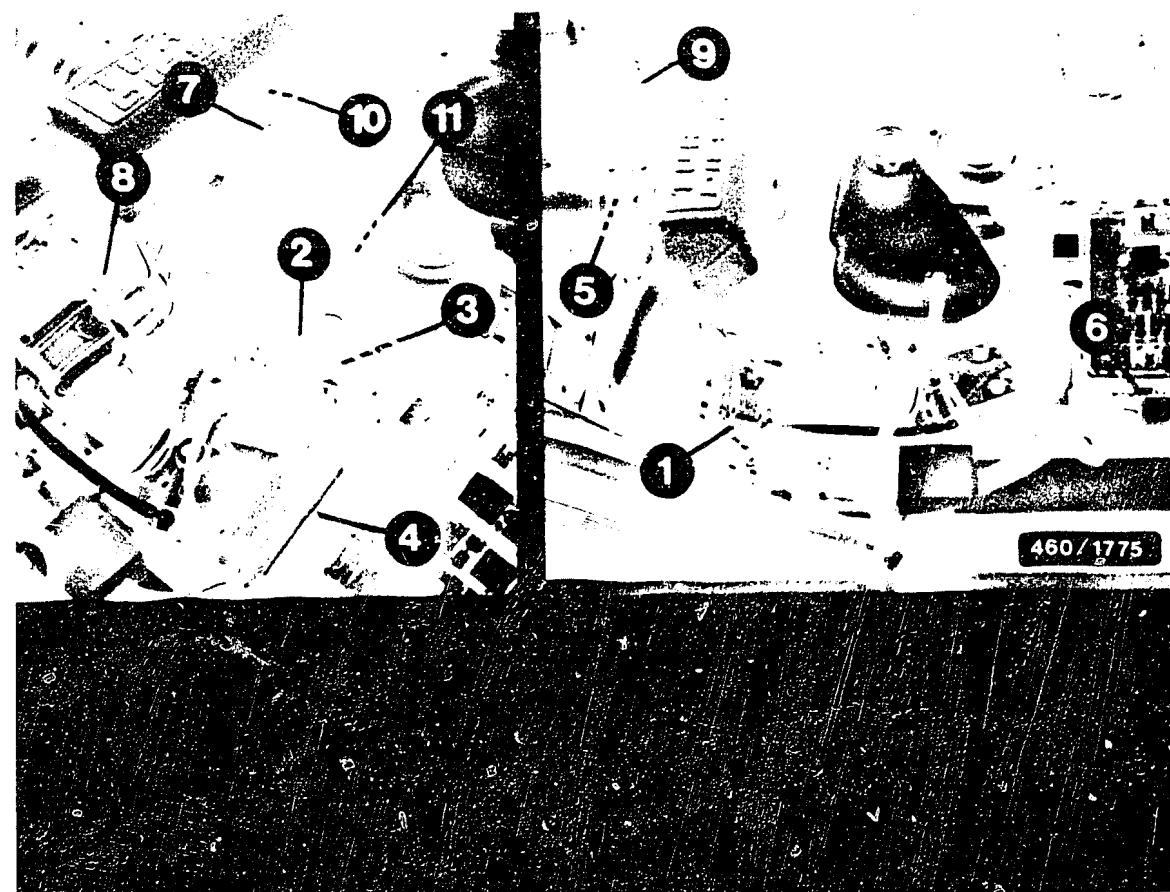


B1 = Temperature sensor (fuel)  
 B2 = Temperature sensor (coolant)  
 B3 = Road-speed sensor  
 (speedometer signal)  
 B4 = Engine-speed sensor  
 B5 = Charge-air pressure sensor  
 B6 = Accelerator-pedal sensor  
 B6.1 = Idle switch  
 B7 = Temperature sensor (air)  
 B8 = Needle-movement sensor  
 H1 = Diagnosis indicator  
 H2 = Stop lamps  
 K1 = Reversed-polarity protection relay  
 ELECTRICAL TERMINAL DIAGRAM

K2 = Electric shutoff device  
 S1\* = Switch (transmission indicator)  
 S2 = Switch (air conditioner)  
 S3 = Operating element, closed-loop  
 road-speed control  
 S4 = Switch (clutch)  
 S5 = Switch (brake)  
 W1 = Diagnosis stimulation  
 X1 = Control-unit plug 1  
 X2 = Control-unit plug 2  
 Y1 = Electropneumatic pressure  
 transducer  
 Y2 = Injection pump

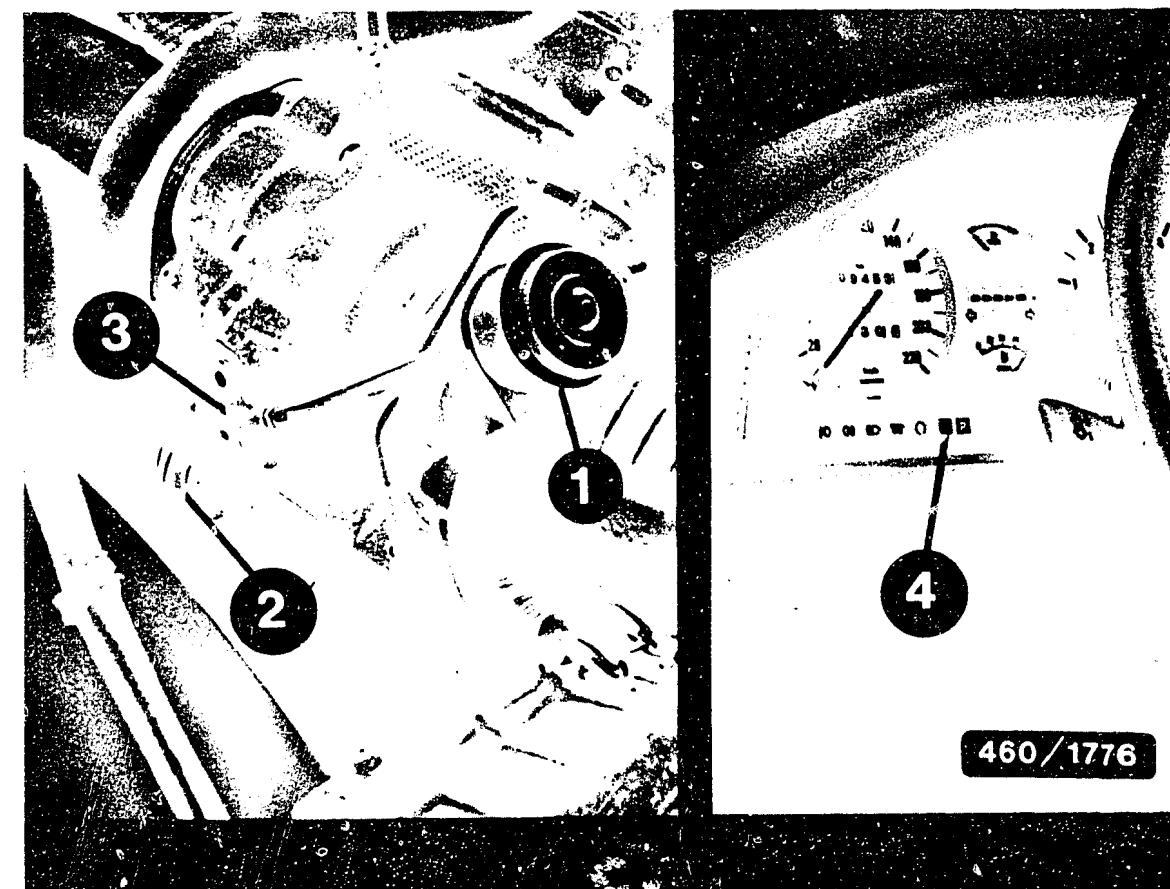
Y2.1 = Delivery controller  
 Y2.2 = Control-collar-travel sensor  
 Y3 = Solenoid-operated valve  
 (start of injection)  
 Y4 = Electropneumatic switch-over  
 valve (EGR)  
 Y5\* = Elektropneumatic switch-  
 over valve

(\* Vehicles with automatic transmission only)



- 1 = Fuel-injection pump
- 2 = Charge-air pressure sensor
- 3 = Electropneumatic switch-over valve (EGR)
- 4 = Glow-duration control unit
- 5 = Injection nozzle with NBF (cylinder 4)
- 6 = Reversed-polarity protection relay
- 7 = Temperature sensor (air)
- 8 = ELAB
- 9 = Diagnostic plug
- 10 = Temperature sensor (coolant)
- 11 = Engine-speed sensor

#### INSTALLATION POSITION OF COMPONENTS



- 1 = Control box
- 2 = Exhaust-gas recirculation valve
- 3 = Bypass-flap actuator
- 4 = Diagnostic lamp

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Solenoid-operated valve (start of injection) and temperature sensor (fuel) are installed in the fuel-injection pump.

Switches (clutch/brake) are mounted above the pedals.

Accelerator-pedal sensor is located to the left of the clutch pedal, above the pedal.

Road-speed sensor is mounted on the differential housing.

Control units are installed in the glove compartment.



Trouble-shooting instructions : BMW-5025

BOSCH system : Electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Make of vehicle : BMW

Basic microcard : FZD-00..

TABLE OF CONTENTS

Section	Coordinates
Special features.....	02
Structure, usage.....	03
Safety and precautionary measures.....	03
Trouble-shooting chart.....	04
Self-diagnosis test table.....	09
Test specifications.....	19
Installation position of components.....	22
Electrical terminal diagram.....	25

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following BMW model:

524 td (E34)  
with electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Engine: M 21 D 24 WA, 85 kW  
EU, 05.88 ->

Vehicles of the country versions  
- Austria  
- Switzerland  
are additionally equipped with an EGR system.

\* EDC system EDC 1.1.2 with self-diagnosis and 2 control units.

\* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

Note:  
Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).

\* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

SPECIAL FEATURES (continued)

- \* The flashing-code fault output is stimulated with the pedal-position sensor.
- \* Vehicles with automatic transmission are equipped with a transmission downshift block.
- \* A fuel pre-supply pump is installed in the fuel tank and is actuated via a relay.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart outlines various causes/component faults. Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

NOTE:  
Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to the information given in the basic instructions, so as not to endanger people and to prevent damage to engine, trigger boxes and control units.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idle with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and the formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	* * * * * Self-diagnosis
*	* * * * * Voltage supply, control units
*	* * * * * Injected-quantity adjuster
*	* * * * * Control-collar travel sensor
*	* * * * * Electric shutoff device (ELAB)
*	* * * * * Computer monitoring (control unit 2)
	* * * * * Solenoid-operated valve, start of injection
	* * * * * Electropneumatic switching valve (EGR)
	* * * * * Nozzle-holder assembly with needle-motion sensor (NBF)
	* * * * * Interface
	* * * * * Computer communication
	* * * * * Engine-speed sensor
*	* * * * * Engine-speed sensor and NBF
*	* * * * * Tank empty, tank ventilation
*	* * * * * Injection sequence not firing sequence

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idling with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	* * * * * Self-diagnosis
	* Inlet-union screw, fuel return line
*	* Air in fuel system
*	Paraffin separation
*	* Leakage in fuel lines
*	Supply lines clogged
*	* * * * * Injection nozzle
*	* * * * * Pump/engine assignment
*	Fuel filter
*	Glow plug system
*	* * * * * Engine compression
	* * * * * Engine air filter
*	* * * * * Engine management
	* * * * * Timing device
	* Turbocharger
	* Charge-air-pressure sensor
*	Fuel heating
	* EGR valve

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
Cause (component fault)	
*	* * * * * Self-diagnosis
	* Pedal-position sensor and brake/brake safety switch
	* Injected-quantity adjuster
	* Control-collar travel sensor
	* Computer monitoring (control unit 1)
	* Engine-speed sensor and needle-motion sensor
*	* * * * * Tank empty, tank ventilation
	* * * * * Injection sequence not firing sequence
*	* * * * * Inlet-union screw, fuel return line
*	* * * * * Air in fuel system
	* * * * * Paraffin separation
*	* * * * * Leakage in fuel lines
*	* * * * * Supply lines clogged

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
Cause (component fault)	
*	Self-diagnosis
*	Pump/engine assignment
*	Fuel filter
*	Engine compression
*	Safety switch, pedal-position sensor
*	Fuel heating
*	Electric shutoff device (ELAB)
*	Engine-speed sensor

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

17.	Diagnosis lamp
18.	High idle
19.	No road-speed control (FGR) operation possible
20.	No EGR function
21.	No idle speed increase
Cause (component fault)	
*	Self-diagnosis
*	Computer monitoring
*	Solenoid-operated valve, start of injection
*	Electropneumatic switching valve (EGR)
*	Nozzle-holder assembly with needle-motion sensor
*	Engine-speed sensor
*	Speed-signal sensor
*	Switch, coupling or transmission neutral switch and/or brake/brake safety switch
*	Air temperature sensor
*	Engine temperature sensor
*	A/C switch
*	Operating element, road-speed control
*	Interface
*	Engine-speed signal
*	Transmission downshift block
*	Electropneumatic switching valve (automatic, FGR)

## SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Temp. sensor Engine Op.circ./sh. to pos.  Short to ground	3	1	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature sensor, resistance: at 15...30°C at approx. 80°C	(CU 1) 23,35	1300...3600 Ω 250... 390 Ω
Speed-sig. sens. Incorrect/no signal	9	7	<u>Correct speed display:</u> engine plug term. 14-ground Test lead for open-circuit: engine plug term. 14-plug Instrument cluster term. 26 and engine plug term. 14-plug Control unit 1 term. 9  <u>No speed display:</u> test speed-signal sensor.  Test lead for open-circuit: speed-signal sensor - instrument cluster	(CU1) 9	> 4,5 V  9 pointer deflections/wheel revolution
Road-sp. cont. - Operating element Op.circ./sh. to pos.  Short to ground	10	3	Switch through FGR operating element positions: neutral N, reactivate RA, set (accelerate) S(a), set (decelerate) S(d), off. Measure voltages at term. 1 and term. 4.  Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Road-speed control (road-speed cont.) = FGR	(CU1) 26,35	N: 3,18...3,69 V RA: 1,43...1,94 V S(a): 0,57...1,08 V S(d): 2,35...2,86 V Off: 3,96...4,47 V
Interface Comp. communication Faulty	11	5	Test leads for open-circuit, kinking and crushing. Loose contacts at plug connections.  <u>Control unit 1 computer monitoring:</u> fault code/flash code may not be indicated. If engine start not possible, control unit 1 defective.	(CU 1) 14,15 (CU 2) 9,12	

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Interface Comp. communication Faulty	11	5	Control unit 2 computer monitoring: fault-memory interrogation not possible. Voltage at plug connection – solenoid valve, start of injection term. 1 with respect to ground with ignition on. If no voltage applied, control unit 2 defective.		12 V
Air-temp. sensor Op. circ./short to positive Short to ground	12	6	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance: at 15...30°C at approx. 80°C		1300...3600 Ω 250... 390 Ω
Eng.-speed sensor Op.circ/grnd short Signal error	129	14*	Test leads for open-circuit and short-circuit to ground. Resistance, engine-speed sensor at approx. 20°C:  Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms. Test leads for open-circuit (op. circ.) and short-circuit to ground.  Resistance, engine-speed sensor at approx. 20°C: Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms.	(CU1) 31,35  (CU1) 31,35	900...1100 Ω   900...1100 Ω Signal pattern, see Coordinate: 20
Fuel temperature sensor Op.circ./sh. to pos. Short to ground	130	4	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301.  Test temperature sensor and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance at 15...30°C: at 50...70°C:	(CU1) 24,35	1200...4000 Ω 300...1200 Ω

\* Serious fault, diagnosis lamp permanently lit

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Pedal-p. sens. Potentiometer Signal too high	132	2	Pedal-position-sensor resistance term. 2 and term. 4 as well as term. 1 and term. 4. Accelerator pedal is in idle position.		800...1400 Ω 800...4110 Ω
Signal too low  Comparison not O.K.			Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. <u>Observe installation instructions for pedal-position sensor.</u> Voltage at pedal-position sensor term. 1 and term. 4. Move accelerator pedal from idle to full-throttle position; Idle position: Full-throttle position:	(CU1) 10,13, 17	0,23...0,50 V 2,79...4,60 V
			<u>Comparison not O.K.</u> Connect multimeter (A) to plug, pedal-position sensor term. 1 and term. 4, multimeter (B) to plug, pedal-position sensor term. 4 and term. 5. Multimeter A: Multimeter B:		0,56... 1,0 V 0... 5,5 V
			Move accelerator pedal from idle and full-throttle position. Step response (B) must result at set value (A). Test lead for open-circuit.	(CU1) 12	
			<u>Dynamic pedal-position-sensor monitoring:</u> No fault indication. High idle, however reaction to accelerator-pedal movement taken place. Eliminate stiffness in accelerator-pedal actuator, check installation position of pedal-position sensor.		

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Ch.-air-pres sens Signal too high Signal too low	133	8	Voltage supply term. 1 (+) and term. 3. Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  Measure voltage with connected charge-air-pressure sensor term. 2 (+) and term. 3.	(CU1) 28,34, 35	4.5...5.5 V  Characteristic curve, see Coord.: 20
Control-collar travel sensor Signal too high Signal too low	134	12	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test voltage supply, socket 2 (+) and socket 3.  Measure resistance: sockets 2 and 3 as well as sockets 1 and 3  Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  <u>Comparison not O.K.</u> Test prerequisites: engine-speed sensor, needle-motion sensor, computer communication interface O.K.  Test leads for open-circuit (see above). Visually inspect injected-quantity adjuster (safety precautions must be heeded).	(CU1) 6,10,29	4.5...5.5 V  1,0...3,0 k $\Omega$ 0,5...2,0 k $\Omega$
Inj.-qty.adjuster Closed loop Faulty	136	10*	Test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test contact resistance term. 4 and 7 - ground.  Measure resistance, injected-quantity adjuster, term. 4 and 7. Test open-circuit in lead, contact resistance, term. 4 and term. 7.	(CU2) 1,21	0,4...0,7 $\Omega$

\* Serious fault, diagnosis lamp permanently lit



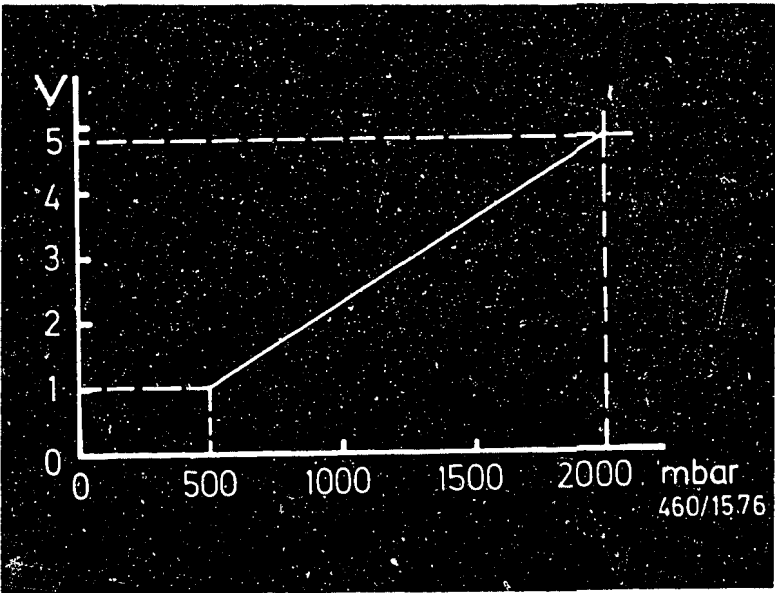
## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Needle-motion sensor Signal too high  Signal too low	142	11*	Measure resistance, needle-motion sensor (approx. 20°...80°C) Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Test contact resistance, terminal posts, needle-motion sensor - ground:	(CU1) 1,20	90... 135 $\Omega$
Start of inj. Closed-loop control Faulty	144	15	Measure resistance, solenoid valve: Test solenoid valve and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Remove fuel-injection pump and test supply pump pressure and timing-device profile.	(CU2) 1,2	14,3...17,3 $\Omega$
Interface Eng.-speed signal Faulty	145	—	Test leads for open-circuit.	(CU 1) 8 (CU 2) 6	
Brake/ brake safety switch Comparison not O.K.	146	—	Brake/brake safety switch (br./br. safety switch) Connect a multimeter to each circuit. Actuate brake pedal several times. Step response: Test voltage supply:  Test leads for open-circuit and contact resistance.	(CU 1) 5,11	Infinity $\Omega$ to approx. 0 $\Omega$ 11,5...14,5 V

\* Serious fault, diagnosis lamp permanently lit

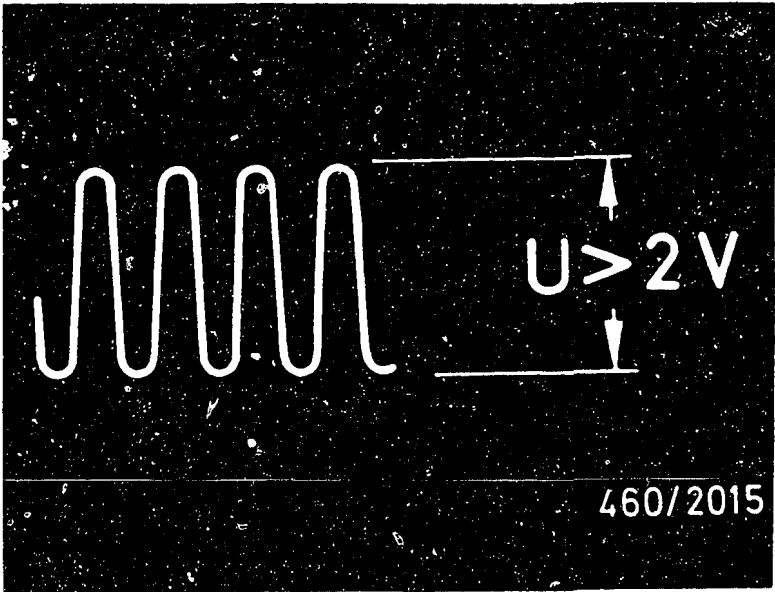
TEST SPECIFICATIONS

Component/Function	Set values	
Idle speed (engine at operating temp., approx. 80° C):		
	Vehicle not moving	Driving speed (>2 km/h)
Manual gear change	750 min <sup>-1</sup>	820 min <sup>-1</sup>
Automatic transm.	750 min <sup>-1</sup>	750 min <sup>-1</sup>
A/C on	800 min <sup>-1</sup>	800 min <sup>-1</sup>
Engine cold	750...1045 min <sup>-1</sup>	
Nozzle opening pressure:	150 + 8 bar	
Pump/engine assignment:		
Setting:		
* Engine setting:	Cylinder 1 at TDC	
* Pump setting	1.05 mm after BDC	
Check value:		
* Engine setting:	Cylinder 1 at TDC	
* Pump setting:	1.03 – 1.07 mm after BDC	
Compression:	25...30 bar	
Max. cylinder deviation:	5 bar	
Filter test; max. permissible difference in pressure:	0.3 bar	
Pressure loss:	max. perm. 25 %	
Vacuum, vacuum pump	>500 mbar	
Electropneum. switching valve (resistance, EGR and FGR)	27...33 Ω	
Charge-air pressure	0.82...0.88 bar	
Blow-off valve, ch.-air pressure	0.90...1.10 bar	
Automatic transmission/downshift block		
Cut-in speed (increasing) :	170 km/h	
Cut-out speed (decreasing):	160 km/h	
Setting X, bracket, control box (FGR)	35.5...36.5mm	



Charac. curve, charge-air-pres. sens.

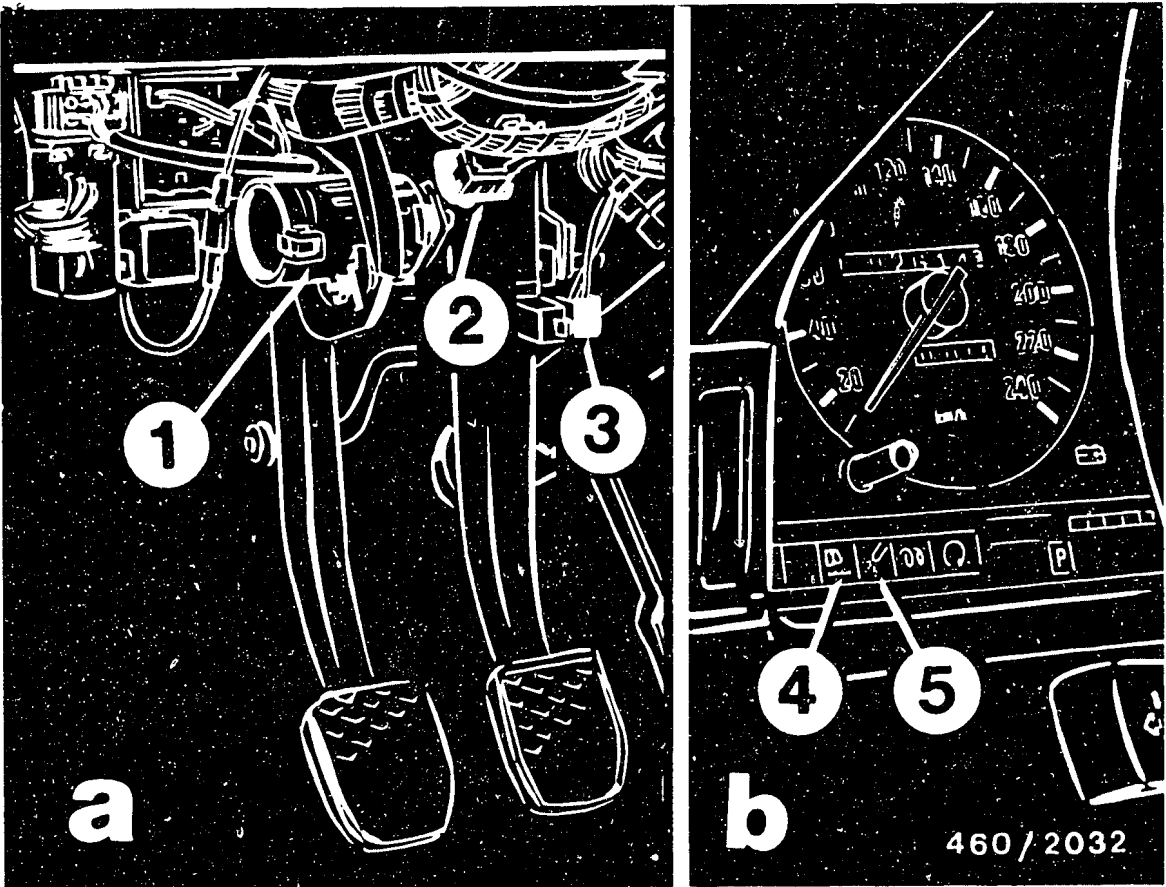
Signal pattern, engine-speed sensor



TEST SPECIFICATIONS (CONTINUED)

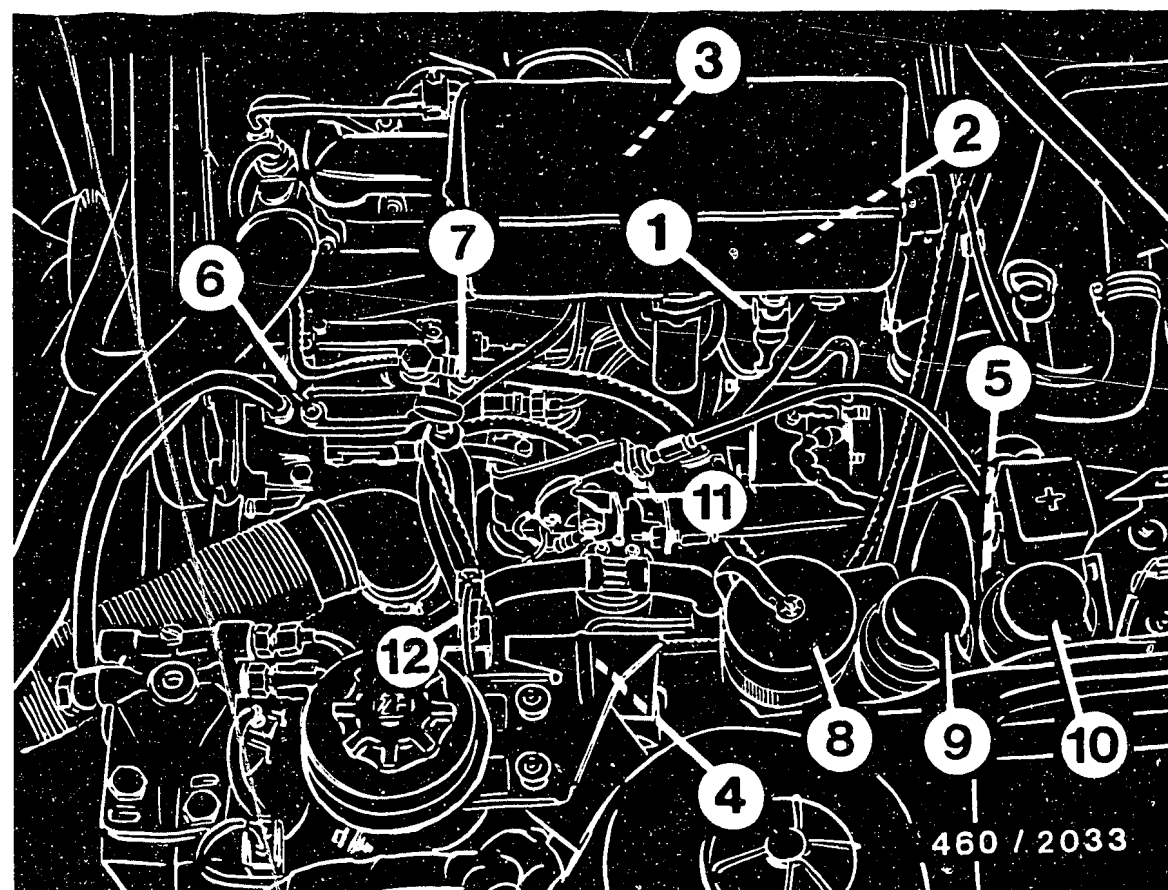
Tightening torques

Fuel lines	25 Nm
Fastening screws, injection pump	20 Nm
Fastening screws, nozzle-holder assembly	40...45 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Cylinder-head-cover screws	7.5 Nm
Nut, injection-pump drive gear	45...50 Nm
Nut, camshaft gear	65...70 Nm
Tensioning-wheel mounting on engine (nut and bolt)	20...24 Nm
Toothed-belt pulley of jack shaft	55...65 Nm
V-belt pulley/vibration damper	22...24 Nm
Tensioning torque for tensioning- roller mounting (new toothed belt)	45...50 Nm
Tightening torque for tensioning- roller mounting (toothed-belt already run > 16 000 km)	30...35 Nm
Bleeder screw/thermostat housing	6...10 Nm



- 1 = Pedal-position sensor
- 2 = Switch, coupling
- 3 = Brake/brake safety switch
- 4 = Indicator, water-level sensor
- 5 = Diagnosis lamp

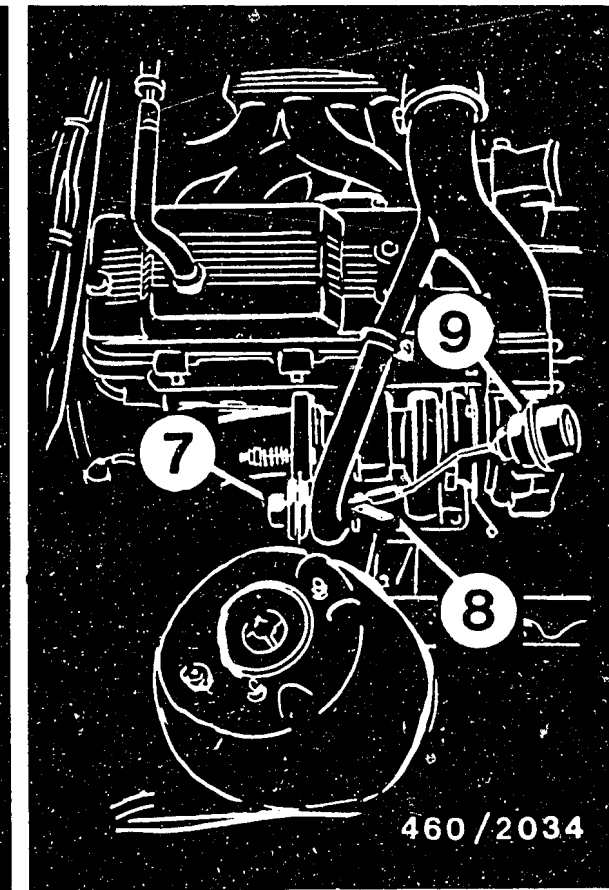
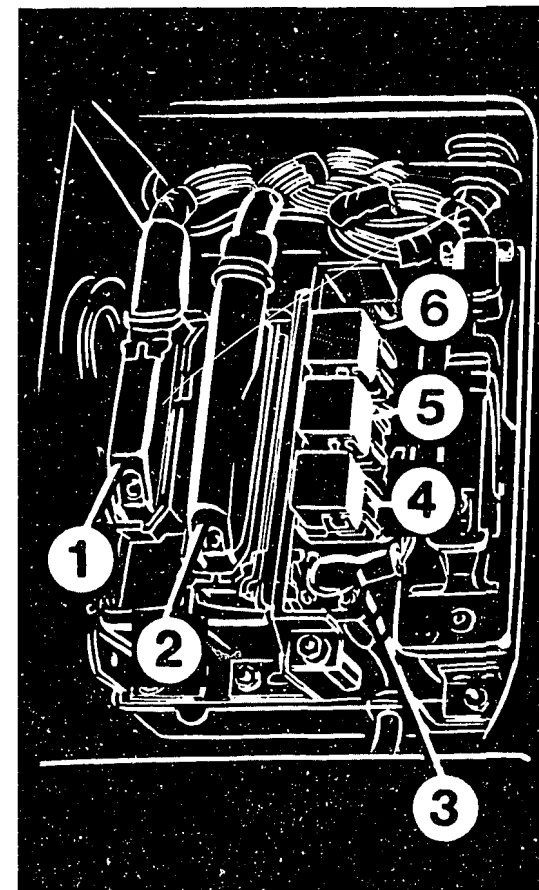
INSTALLATION POSITION OF COMPONENTS  
The road-speed pickup is attached to the differential housing.  
The road-speed-control operating element is located beneath the lever for actuating the windshield wipers.  
The electropneumatic switching valve (downshift block) is installed in the transmission; the transmission neutral switch is installed in the gear-shift console.



- 1 = Air temperature sensor
- 2 = Engine temperature sensor
- 3 = Nozzle-holder assembly with NBF (cyl. 4)
- 4 = Charge-air-pressure sensor
- 5 = Engine-speed sensor
- 6 = Fuel-injection pump
- 7 = ELAB
- 8 = Diagnosis plug
- 9 = Engine plug 2
- 10 = Engine plug 1
- 11 = Automatic transmission control (control box (FGR) and transmission indicator on one holding plate)
- 12 = Electropneumatic switching valve (FGR)

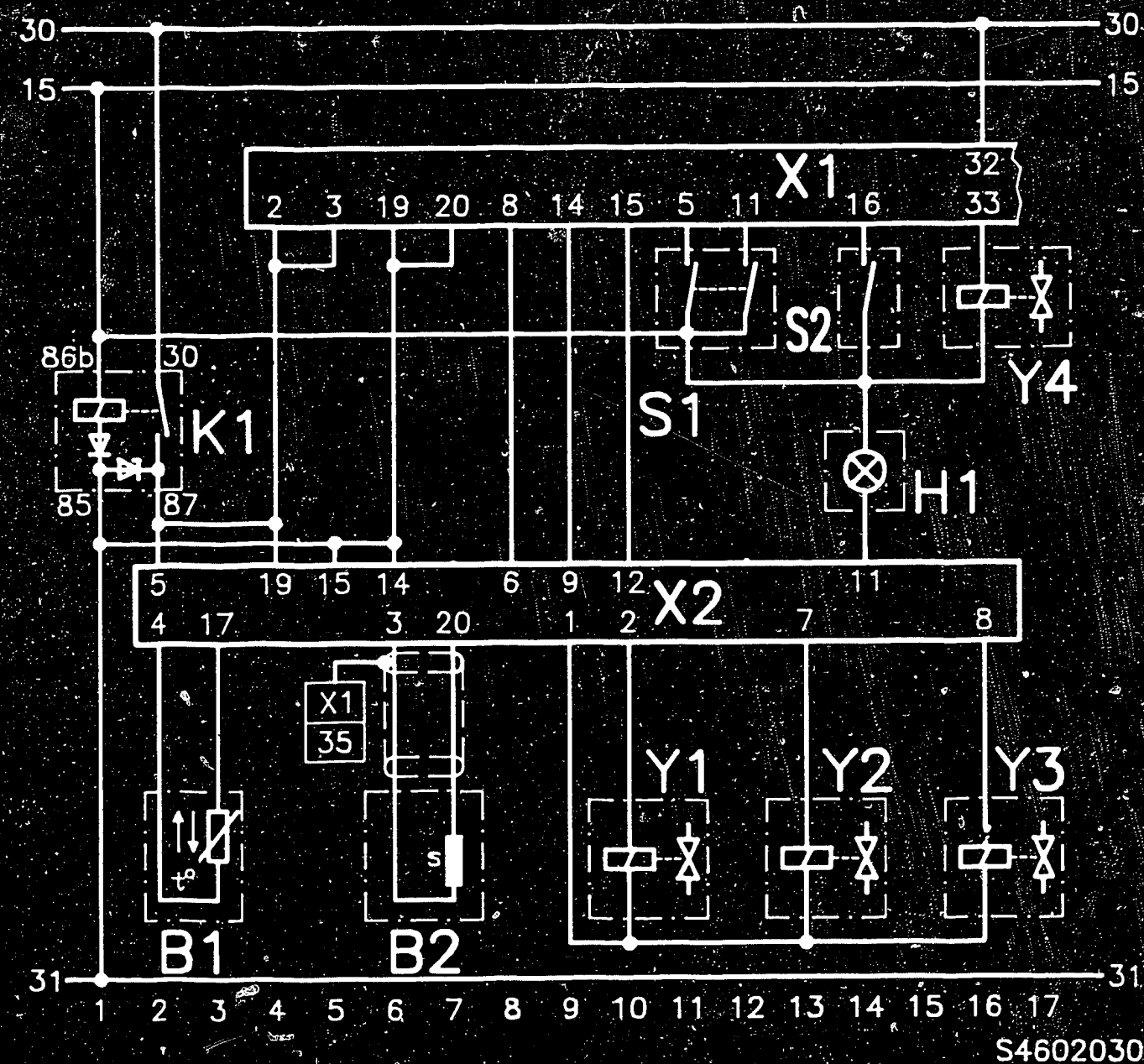
#### INSTALLATION POSITION OF COMPONENTS (continued)

Solenoid-operated valve for start of injection and fuel temperature sensor are installed in fuel-injection pump.



#### INSTALLATION POSITION OF COMPONENTS (continued)

- 1 = Control unit 2
- 2 = Control unit 1
- 3 = Glow-duration unit (not visible in picture)
- 4 = Pre-supply pump relay
- 5 = Fuel-heating relay
- 6 = Reversed-polarity protection relay
- 7 = EGR valve
- 8 = Bypass-flap actuator
- 9 = Control box

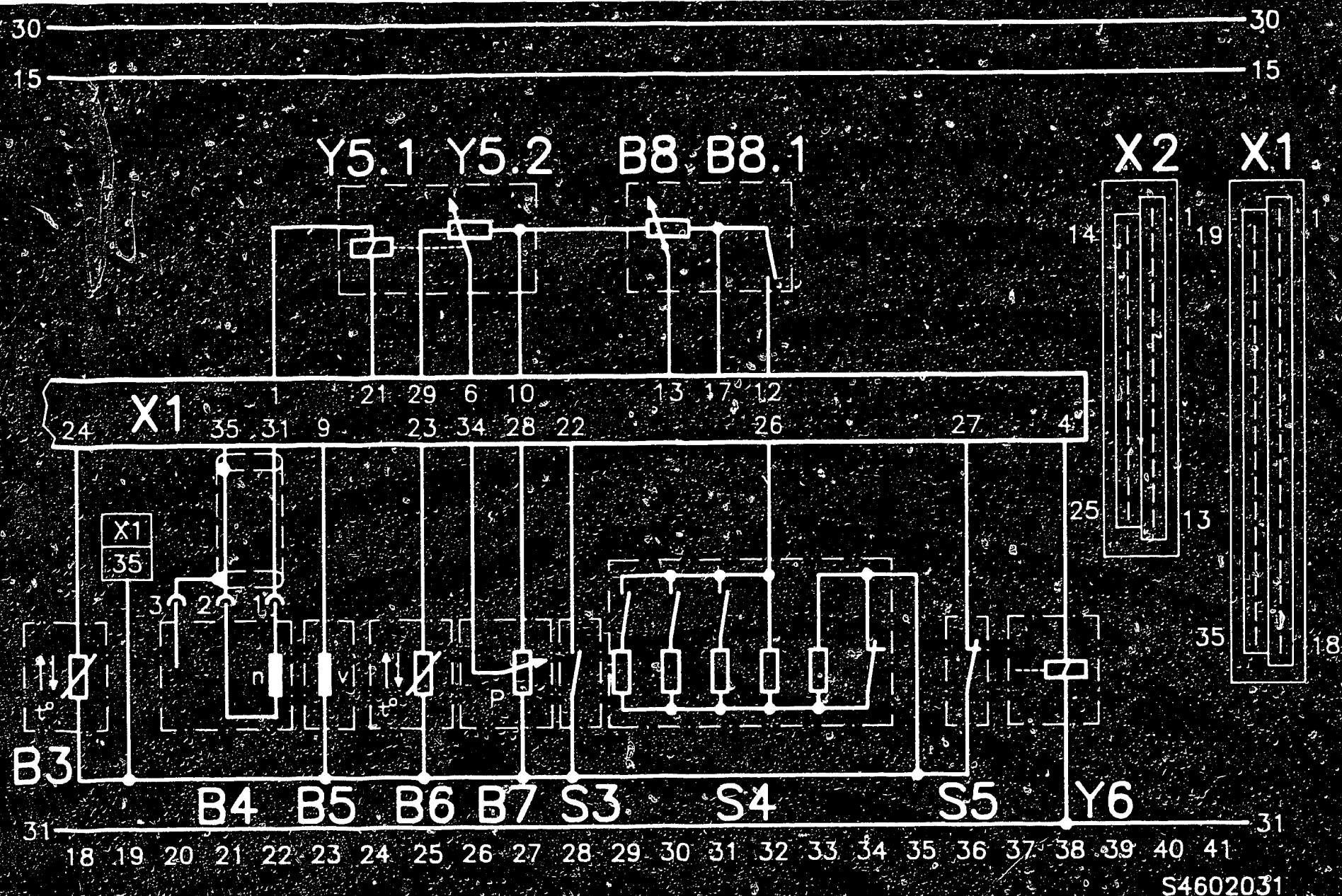


# ELECTRICAL TERMINAL DIAGRAM

B1 = Air temperature sensor  
 B2 = Needle-motion sensor  
 H1 = Diagnosis lamp  
 K1 = Reversed-polarity protection relay  
 S1 = Brake/brake safety switch  
 S2 = A/C switch  
 X1 = Control unit 1  
 X2 = Control unit 2

Y1 = Solenoid-operated valve, start of injection  
 Y2 = Electropneumatic switching valve (EGR)  
 Y3\* = Electropneumatic switching valve  
 Y4\* = Transmission downshift block

(\* Only for vehicles with automatic transmission)



# ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

B3 = Fuel temperature sensor  
 B4 = Engine-speed sensor  
 B5 = Speed-signal sensor  
 (speedometer signal)  
 B6 = Engine temperature sensor  
 B7 = Charge-air-pressure sensor  
 B8 = Pedal-position sensor  
 B8.1 = Safety switch  
 S3 \* = Transmission indicator

S4 = Road-speed-control operating element  
 S5 = Switch, coupling (for vehicles with  
 automatic transmission, transmission  
 neutral switch)  
 X1 = Control unit 1  
 X2 = Control unit 2  
 Y5.1 = Injected-quantity adjuster  
 Y5.2 = Control-collar travel sensor  
 Y6 = Electric shutoff device

(\* Only for vehicles with automatic transmission)

Trouble-shooting instructions : BMW-5029

BOSCH system : Electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Make of vehicle : BMW

Basic microcard : FZD-00..

TABLE OF CONTENTS

Section	Coordinates
Special features.....	02
Structure, usage.....	04
Safety and precautionary measures.....	04
Trouble-shooting chart.....	05
Test specifications.....	10
Self-diagnosis test table.....	11
Electrical terminal diagram.....	23
Installation position of components.....	25

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following BMW model:

324 d (E30)  
with electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Engine: M 21 D 24 W, 64 kW  
EU, 03.89

Vehicles of country versions  
- Austria  
- Switzerland  
are additionally equipped with an EGR system.

\* EDC system EDC 1.2.1 with self-diagnosis and 55-pole control-unit plug.

\* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.1989.

Note:  
Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).

If it is not possible to establish communication with the control unit, detach adapter lead at diagnosis plug. With ignition switched on, briefly connect term. 15 and term. 19 of diagnosis plug to commercially available test lead and test prods (connect stimulation lead to ground). Reconnect adapter lead.



- \* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).
- \* Stimulate flashing code with throttle position sensor following completion of lamp test (5 x fully depressed accelerator pedal in a time period of 5 seconds with ignition switched on).  
The flashing-code output starts with a longer individual flashing pulse to be followed by a pause of the same length. The actual code output then takes place. Stimulation is required after each individual flashing-code output.
- \* The FGR (FGR = cruise control) operating unit is permanently recognized as being defective in the case of vehicles without cruise control.
- \* The control-unit terminal designations used in these trouble-shooting instructions do not coincide with those in the stated basic instructions. The same applies to the test-step numbering.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

Pay attention to information given in basic instructions, so as not to endanger persons and so as to avoid damaging engine, trigger boxes and control units.



## TROUBLE-SHOOTING CHART (continued)

## Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idling with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	Self-diagnosis
*	Voltage supply, control units
*	Injected-quantity adjuster
*	Control-collar travel sensor
*	Electric shutoff device (ELAB)
*	Computer monitoring
	Solenoid-operated valve, start of injection
	Electropneumatic switching valve (EGR)
	Nozzle-holder assembly with needle-motion sensor (NBF)
	Interface
	Computer communication
	Engine-speed sensor
*	Engine-speed sensor and NBF
*	Tank empty, tank ventilation
*	Injection sequence not firing sequence

## TROUBLE-SHOOTING CHART (continued)

## Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idling with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	Self-diagnosis
	Inlet-union screw (fuel return line)
*	Air in fuel system
*	Paraffin separation
*	Leakage in fuel lines
*	Supply lines clogged
*	Injection nozzle
*	Pump/engine assignment
*	Fuel filter
*	Glow plug system
*	Engine compression
	Engine air filter
*	Engine management
	Timing device
*	Fuel heating
	EGR valve

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
	Cause (component fault)
*	Self-diagnosis
	Pedal-position sensor and brake/brake safety switch
	Injected-quantity adjuster
	Control-collar travel sensor
	Computer monitoring
	Engine-speed sensor and needle-motion sensor
*	Tank empty, tank ventilation
	Injection sequence not firing sequence
*	Inlet-union screw, fuel return line
*	Air in fuel system
	Paraffin separation
*	Leakage in fuel lines
*	Supply lines clogged

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
	Cause (component fault)
*	Self-diagnosis
	Pump/engine assignment
	Fuel filter
	Engine compression
	Safety switch, pedal-position sensor
*	Fuel heating
*	Electric shutoff device (ELAB)
	Engine-speed sensor

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

17. Diagnosis lamp

## 18. High idle

19. No road-speed control (FGR) operation possible

20 No EGR function

21. No idle speed increase

						Cause (component fault)
*	*	*	*	*		Self-diagnosis
			*			Computer monitoring
			*			Solenoid-operated valve, start of injection
			*			Electropneumatic switching valve (EGR)
			*			Nozzle-holder assembly with needle-motion sensor
*		*				Engine-speed sensor
*		*				Speed-signal sensor
		*				Switch, coupling or transmission neutral switch and/or brake/brake safety switch
		*				Air temperature sensor
		*				Engine temperature sensor
			*			A/C switch
	*					Operating element, road-speed control
	*					Interface Engine-speed signal
	*					Electropneumatic switching valve (automatic, RSC)

## TEST SPECIFICATIONS

Component/function

## Set values

Idle speed (engine at norm. op. temp., approx. 80° C):

	Vehicle at stand- still	Road speed (>2 km/h)
Manual trans.	705 min <sup>-1</sup>	770 min <sup>-1</sup>
Automatic trans.	705 min <sup>-1</sup>	770 min <sup>-1</sup>
Air-cond. control switched on	800 min <sup>-1</sup>	800 min <sup>-1</sup>
Engine cold	705...1090 min <sup>-1</sup>	

Nozzle-opening pressure: 150 + 8 bar

Coordination, pump - engine (inj. timing):

Setting:

```
* Engine position:      Cylinder 1 at TDC
* Pump position:       1.05 mm after BDC
```

Check value:

```
* Engine position:      Cylinder 1 at TDC
* Pump position:       1.03 - 1.07 mm after BDC
```

---

Compression: 25...30 bar

Max. diff. between cylinders: 5 bar

Filter test, max. permissible  
differential pressure: 0.3 bar

Pressure drop: max. permissible 25 %

Vacuum, vacuum pump	>500 mbar
---------------------	-----------

Electropneum. switch-over valve 27...33  $\Omega$

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Temp. sensor Engine Op.circ./sh. to pos.  Short to ground	3	7	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Temperature sensor, resistance: at 20...40°C at approx. 80°C	13, 53	1,1...2,7 Ω 0,3...0,34 Ω
Speed-sig. sens. Incorrect/no signal	9	28	<u>Correct speed display:</u> engine plug term. 14-ground Test lead for open-circuit: engine plug term. 14-plug Instrument cluster term. 26 and engine plug term. 14-plug Control unit term. 29  <u>No speed display:</u> test speed-signal sensor.  Test lead for open-circuit: speed-signal sensor – instrument cluster	29	> 1,0 V   9 pointer deflections/wheel revolution
Road-sp. cont. – Operating element Op.circ./sh. to pos.  Short to ground	10	29	Switch through FGR operating element positions: neutral N, reactivate RA, set (accelerate) S(a), set (decelerate) S(d), off. Measure voltages at term. 1 and term. 4.  Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Road-speed control (road-speed cont.) = FGR	13,20	N: 3,18...3,69 V RA: 1,43...1,94 V S(a): 0,57...1,08 V S(d): 2,35...2,86 V Off: 3,96...4,47 V
Interface Comp. communication Faulty	11	13	Renew control unit.		

SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Air-temp. sensor Op. circ./short to positive  Short to ground	12	15	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance: at 20...40°C at approx. 80°C	13, 52	1,1...2,7 Ω 0,3...0,34 Ω
Battery voltage  too low	23	10	Perform test in accordance with basic instructions (check voltage supply).	15, 16, 17	
Eng.-speed sensor Op.circ/grnd short  Signal error	129	5*	Test leads for open-circuit and short-circuit to ground. Resistance, engine-speed sensor at approx. 20°C:  Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms. Test leads for open-circuit (op. circ.) and short-circuit to ground.  Resistance, engine-speed sensor at approx. 20°C: Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms.	13, 47,	830...1360 Ω    830...1360 Ω
Fuel temperature sensor Op.circ./sh. to pos.  Short to ground	130	16	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301.  Test temperature sensor and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance at 15...30°C: at 50...70°C:	13, 35,	1200...4000 Ω 300...1200 Ω

\* Serious fault, diagnosis lamp permanently lit



1

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Con.-col.tvl.sen.  Signal too high  Signal too low	134	3	<p>Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test voltage supply, socket 2 (+) and socket 3.</p> <p>Measure resistance: sockets 2 and 3 as well as sockets 1 and 3</p> <p>Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.</p> <p>4 <u>Comparison not O.K.</u> Test prerequisites: engine-speed sensor, needle-motion sensor, computer communication interface O.K.</p> <p>Test leads for open-circuit (see above). Visually inspect injected-quantity adjuster (safety instructions must be heeded).</p>	14, 21, 39	<p>4.5...5.5 V</p> <p>1,0...3,0 k <math>\Omega</math> 0,5...2,0 k <math>\Omega</math></p>
Flow actuator control circuit defective	136	30	<p>Test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Check contact resistance term. 4 and 7 - ground.</p> <p>Measure resistance, flow actuator, term. 4 and 7. Check for open circuit in lead, contact resistance term. 4 and term. 7</p>	1, 2, 15, 16, 17	0,4...0,7 $\Omega$
Needle sensor  Signal too high  Signal too low	142	21*	<p>Measure resistance, needle sensor (approx. 20°...80°C) Check leads for open circuit (op. circ.), short to positive and short to ground.</p> <p>Check contact resistance, pins, needle sensor with respect to ground.</p>	5, 12	90...135 $\Omega$

\* Serious fault, diagnosis lamp continuously lit

SELF-DIAGNOSIS TEST TABLE (continued)

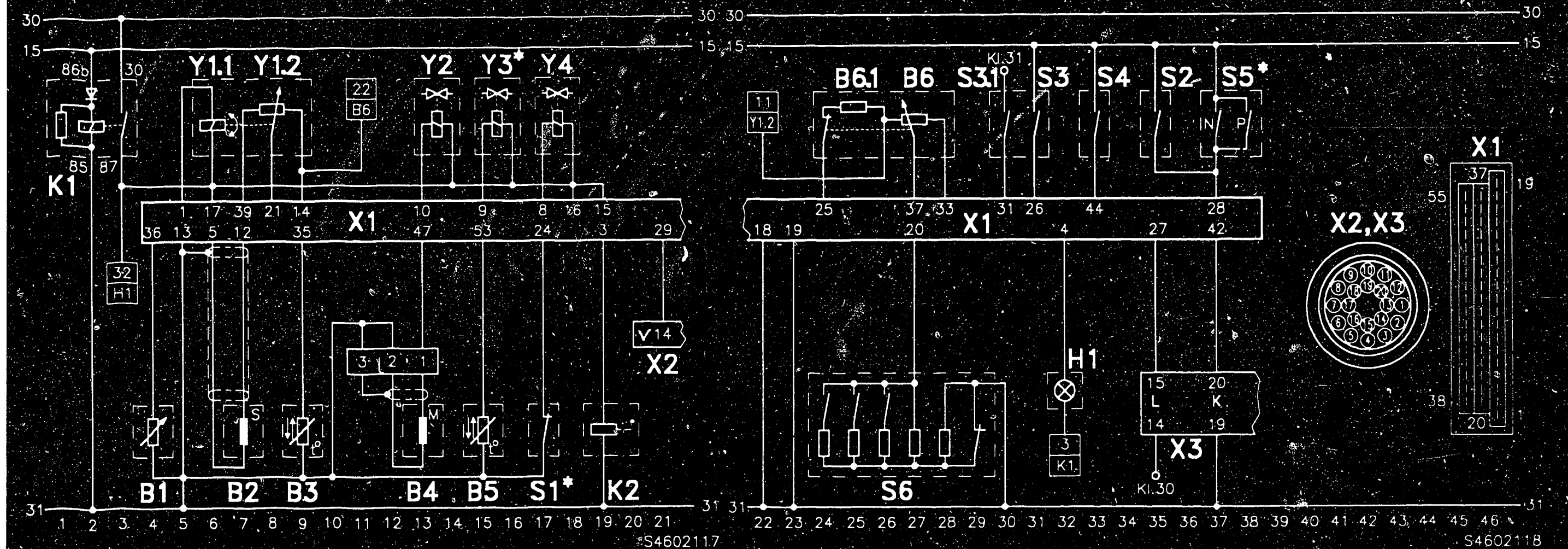
Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Start of inj. Closed-loop control Faulty	144	19	Measure resistance, solenoid valve: Test solenoid valve and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Remove fuel-injection pump and test both supply pump pressure and timing-device profile.	10, 15	14,3...17,3 $\Omega$
Brake/brake safety switch Comparison not O.K.	146	31	Brake/brake safety switch (br./br. safety switch) Connect a multimeter to each circuit. Press brake pedal several times. Step response: Test voltage supply:  Test leads for open-circuit and contact resistance.	13, 26, 31	infinity $\Omega$ to approx. 0 $\Omega$ 11,5...14,5 V
Atmospheric pressure sensor Signal too high  Signal too low	147	22	Establish atmospheric pressure. Control-unit version 3S1: actual value > desired value, fault "signal too high" detected. Actual value < desired value, no error message. If error message present, renew control unit. Control-unit version 3S2: if error message present, renew control unit.		1050 hPa
Electron. idle shut-off device defective	148	25*	Carry out testing in accordance with basic instructions (trouble-shooting program, electric shut-off device).		

\* Serious fault, diagnosis lamp continuously lit



SELF-DIAGNOSIS TEST TABLE (continued)

CU output stages Short to B+	149	32	Resistance, solenoid valve (start of injection): Check for short to positive (B+):	10	14,3...17,3 Ω
			Resistance, electropneumatic switching valve (FGR for automatic transmission): Check for short to positive (B+):	9	27...33 Ω
			Resistance, electropneumatic switching valve (EGR) Check for short to positive (B+):	8	27...33 Ω
Water level display active/defective	150	27	Carry out testing in accordance with basic instructions (trouble-shooting program, water level display).		

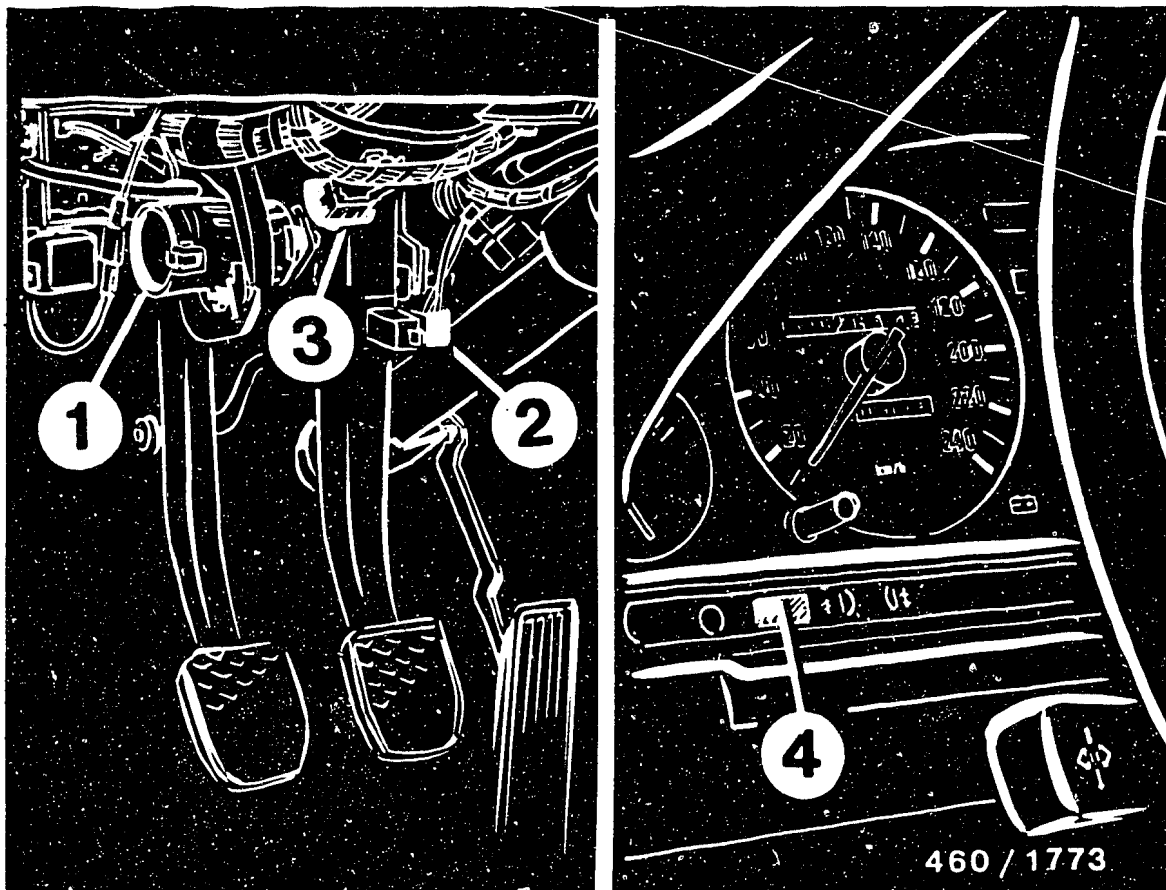


## ELECTRICAL TERMINAL DIAGRAM

B1 = Water level sensor  
 B2 = Needle movement sensor  
 B3 = Temperature sensor (fuel)  
 B4 = Engine-speed sensor  
 B5 = Temperature sensor (coolant)  
 B6 = Throttle position sensor  
 B6.1=Idle switch  
 H1 = Diagnosis lamp  
 K1 = Reversed-polarity protection relay  
 K2 = Electric shutoff device (ELAB)

S1\*= Switch (transmission indicator)  
 S2 = Switch (clutch)  
 S3 = Switch (brake)  
 S3.1=Switch (brake safety)  
 S4 = Switch (A/C)  
 S5\*= Transmission neutral switch  
 S6 = Cruise-control operating unit  
 X1 = Control unit  
 X2 = Engine plug

X3 = Diagnosis plug  
 Y1.1=Injected-quantity adjuster  
 Y1.2=Control-collar travel sensor  
 Y2 = Solenoid valve (start of injection)  
 Y3\*= Electropneumatic switching valve  
 Y4 = Electropneumatic switching valve (EGR)

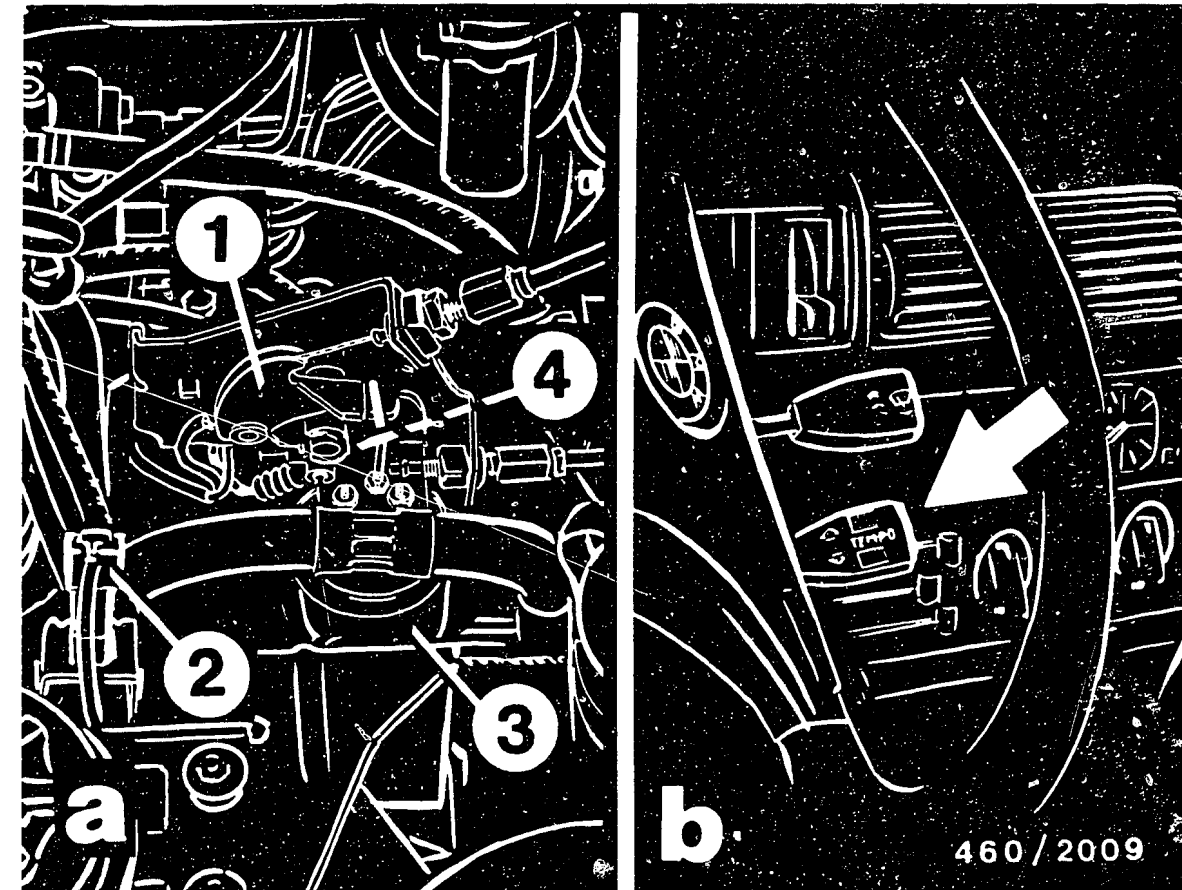


- 1 = Throttle position sensor
- 2 = Switch (brake/brake safety)
- 3 = Switch (clutch)
- 4 = Diagnostic lamp (in connection with water-level sensor indicator)

#### INSTALLATION POSITION OF COMPONENTS

Road-speed sensor is built onto the differential housing.

Control unit is installed in the glove compartment.

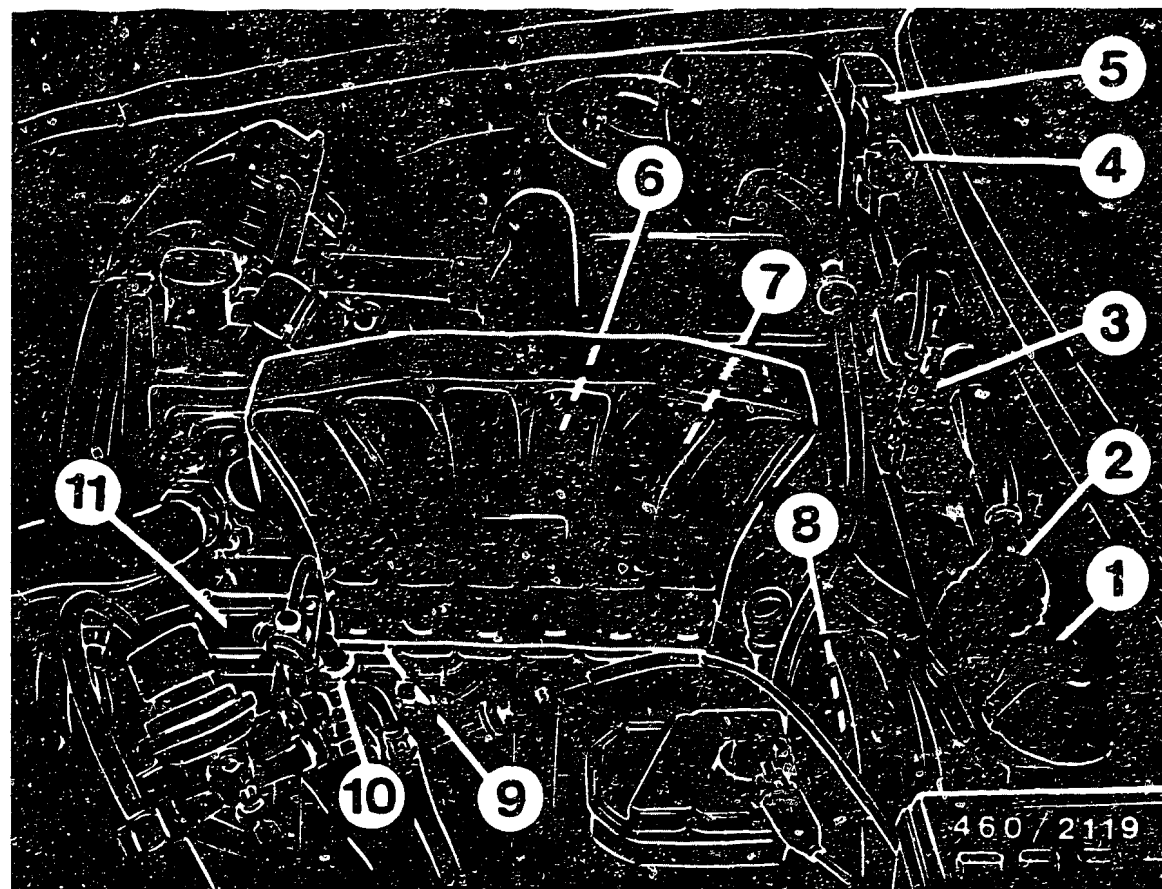


#### Vehicles with automatic transmission (picture a)

- 1 = Automatic transmission control
- 2 = Electropneumatic switching valve (FGR)
- 3 = Control unit (FGR)
- 4 = Transmission indicator (not visible in picture)

The electropneumatic switching valve is installed in the transmission, whereas the transmission neutral switch is installed in the gear-shift console.

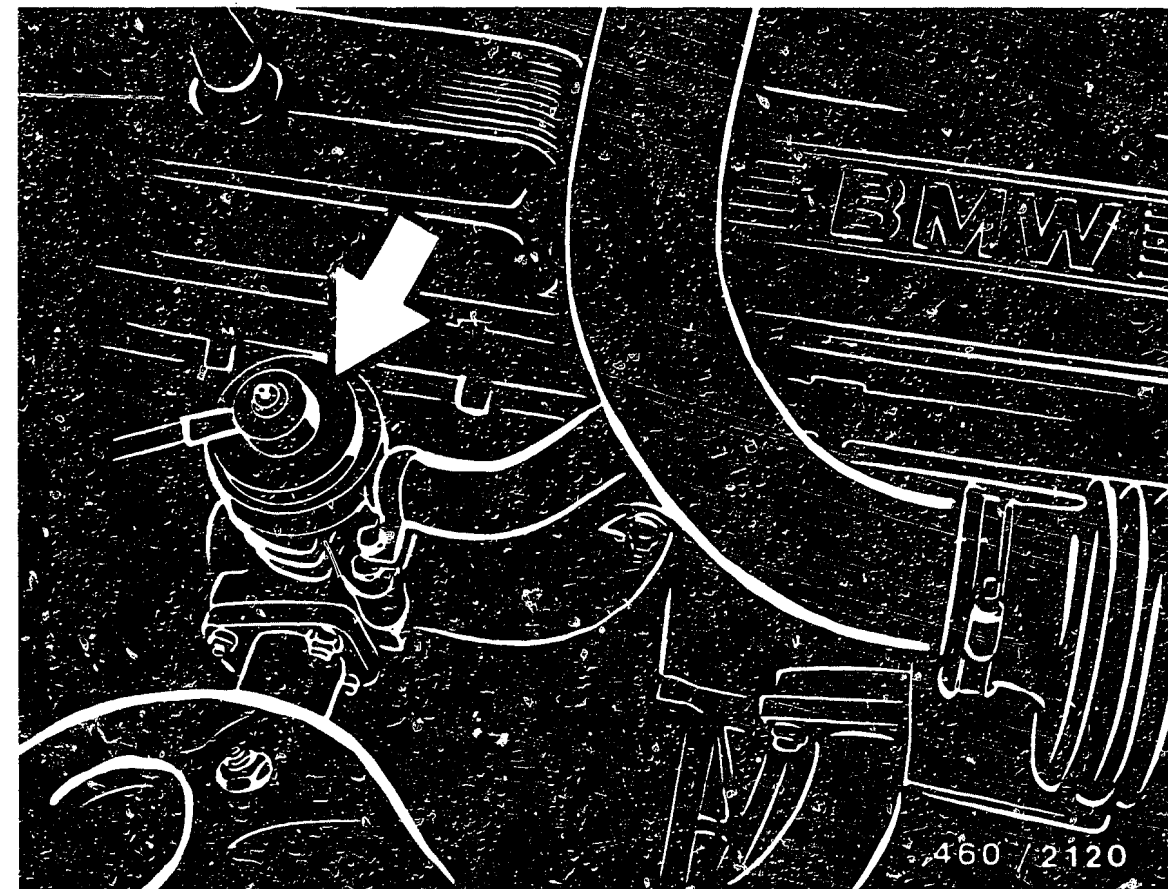
Cruise-control operating unit (picture b, arrow).



- 1 = Diagnosis plug
- 2 = Engine plug
- 3 = Reversed-polarity protection relay
- 4 = Electropneumatic switching valve (EGR)
- 5 = Glow-duration unit
- 6 = Nozzle-holder assembly with NBF (4 cyl.)
- 7 = Temperature sensor (coolant)
- 8 = Engine-speed sensor
- 9 = Temperature sensor (air)
- 10 = Electric shutoff device (ELAB)
- 11 = Fuel-injection pump

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Solenoid valve (start of injection) and temperature sensor (fuel) are installed in fuel-injection pump.



#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Arrow: EGR valve

Trouble-shooting instructions : LAI-5000  
BOSCH system : VE..F.. pump  
Vehicle make : LANCIA  
Basic microcard : FZD-00..

TABLE OF CONTENTS

Section	Coordinate
Special features.....	01
Test specifications.....	05
Preheating system terminal diagram.....	07
Test equipment and tools.....	09
Removing fuel-injection pump.....	11
Installing fuel-injection pump.....	16
Testing and adjusting engine timing.....	23

SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models current at the time of writing:

- \* LANCIA Prisma Diesel (6.84 ->)  
Engine 831.D.000 (1.9 l / 48 kW)
- \* LANCIA Prisma Turbo-Diesel (5.85 ->)  
Engine 831.D1.000 (1.9 l / 59 kW)

Please note:

Even when referring to basic instructions, the nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding.

## \* Checking charge-air pressure

When working on the turbo-supercharger, note that even the smallest particles of contamination can lead to the destruction of the supercharger. For this reason, the engine should never be operated without an air filter. Pressure-measuring device KDJE P 100 or a 0...1.6 bar pressure gauge (e.g. Wika no. 4184) can be used to test charge-air pressure.

The charge-air pressure should be measured under full load, on a chassis dynamometer wherever possible. At 2400 min<sup>-1</sup>, the charge-air pressure is 0.8 bar.

### Note:

Evaluation of the condition of an exhaust turbo-supercharger requires that start of delivery and nozzle-opening pressure are correctly set, that the induction and exhaust sides show no leakage, and that the engine is in good mechanical condition (valve clearance, compression).

If the charge-air-pressure control valve is defective, replace the exhaust turbo-supercharger. After installing a new exhaust turbo-supercharger, fill the supercharger with oil and let the engine run about 1 minute in idle, in order to guarantee oil supply to the supercharger.

For production reasons:  
continued on the following  
coordinate.

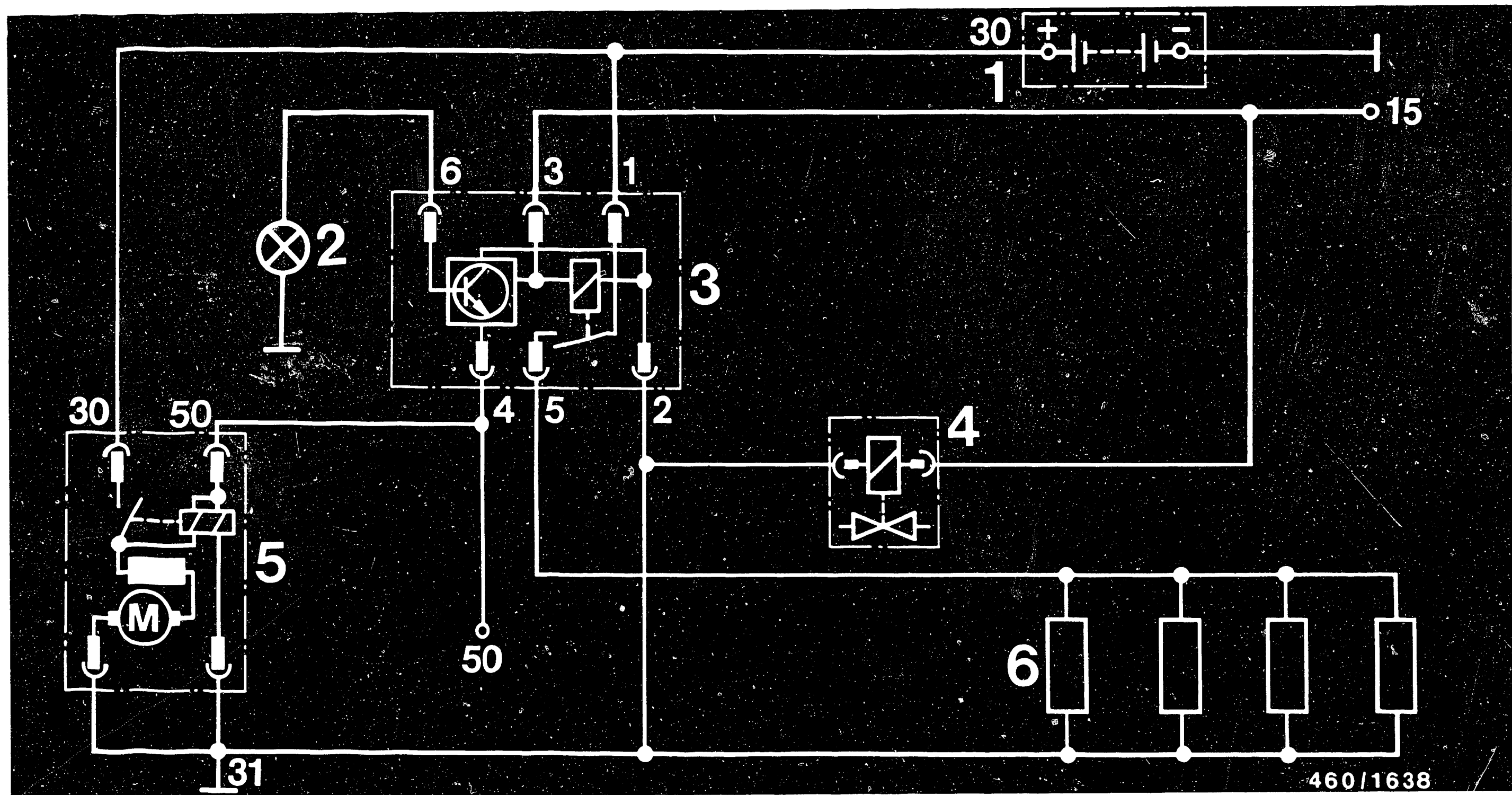
TEST SPECIFICATIONS

* Idle speed:	740...800 min <sup>-1</sup>
* Nozzle-opening pressure:	150 + 8 bar (engine 831.D1.000)  130 + 8 bar (engine 831.D.000)
* Charge-air pressure:	0,8 bar
* Compression:	21 ± 0,5 bar
* Pump-engine coordination	
Engine position:	1rst cylinder at TDC
Setting value (static)	
Pump position:	1 mm after BDC

Test specifications (continued)

Tightening torques:

* Sheathed-element glow plugs	15 Nm
* Nozzle- and-holder assembly	78 Nm
* Fuel-injection pump gear (hex nut)	49 Nm
* Fuel lines (union nut)	25 Nm
* Fastening nuts and bolts for fuel- injection pump	23 Nm
* Toothed-belt tensioning roller (hex nut)	44 Nm



- |                               |                             |                    |
|-------------------------------|-----------------------------|--------------------|
| 1 = Battery                   | 3 = Glow-duration unit      | 5 = Starting motor |
| 2 = Preheating indicator lamp | 4 = Solenoid-operated valve | 6 = Glow plugs     |

PREHEATING SYSTEM TERMINAL DIAGRAM

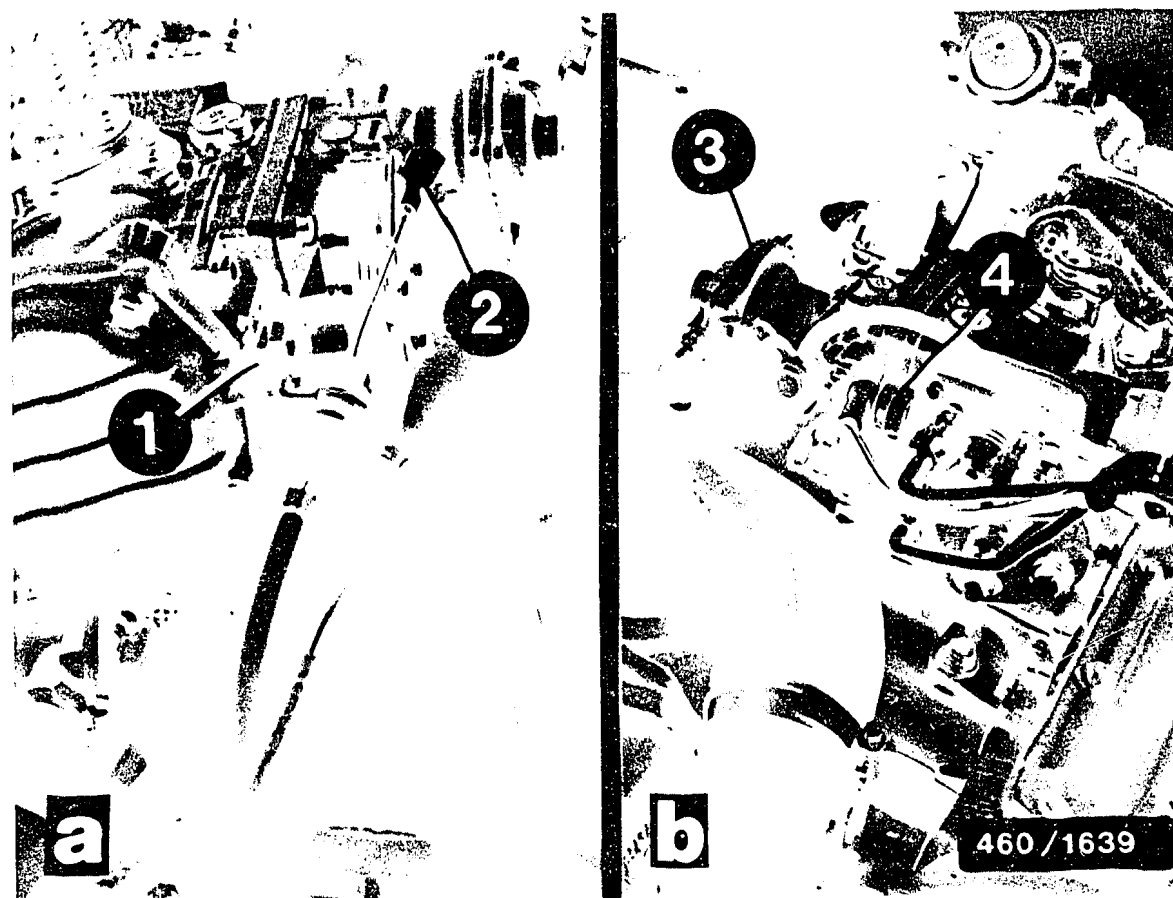


## TEST EQUIPMENT AND TOOLS

Description	Part number	Application
Box wrench	KDEP 1115	Loosening/ tightening fuel- injection tubing
Measuring device	KDEP 1085	Coordinating pump and engine
Small dial indicator 1/100 mm graduation	1 687 233 011	Coordinating pump and engine
Pressure-measuring device or Pressure gauge 0...1.6 bar	KDJE-P 100  e.g. Wika no. 4 184	Testing charge-air pressure
Puller	KDEP 1118	Pulling off toothed-belt gear
Tensioning tool (*)	FIAT part no. 1 860 745 100 or 1 860 745 200	Adjusting toothed- belt tension
Threaded pin (*)	FIAT part no. 1 860 473 000	Locking the camshaft-drive belt gear

(\*) Obtain tools from local FIAT dealer.

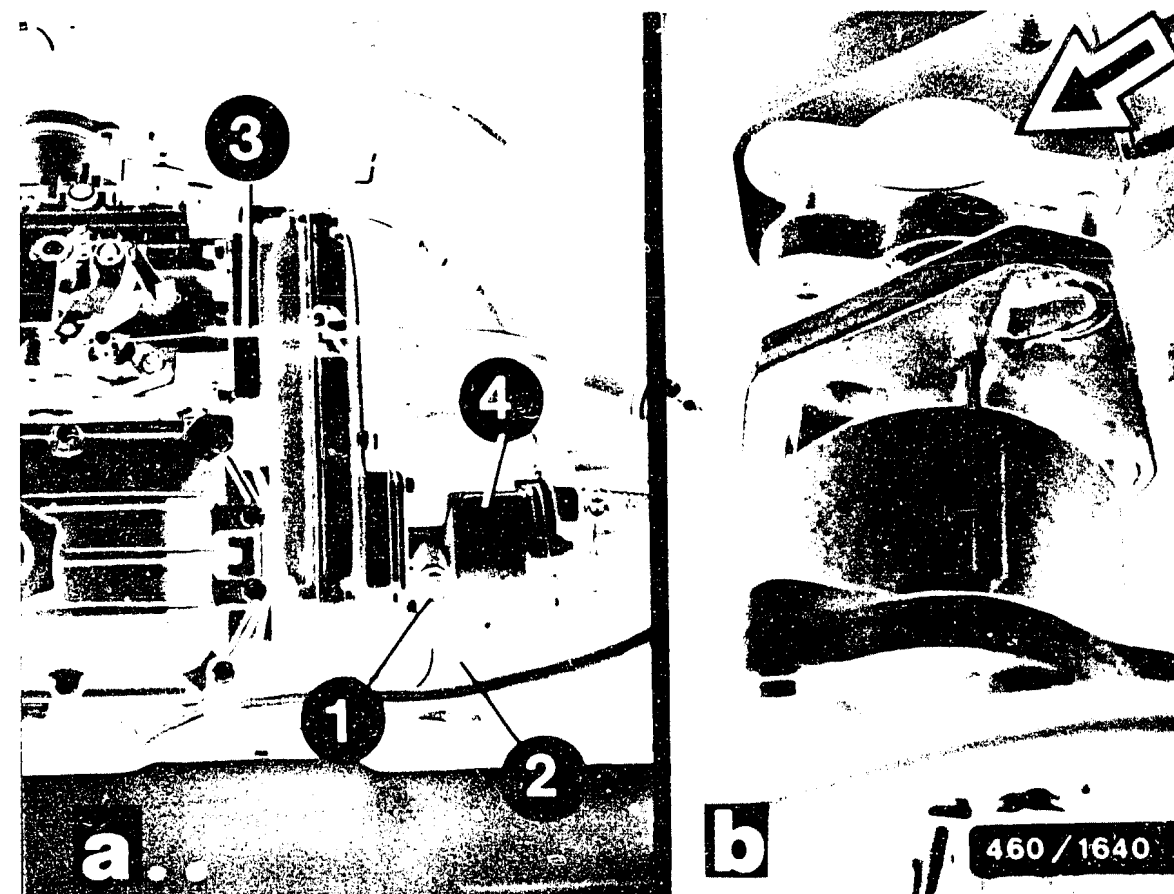
For production reasons:  
continued on the following  
coordinate.



- 1 = Fuel supply line
- 2 = Bowden cable (accelerator pedal)
- 3 = Manifold-pressure compensator (LDA)
- 4 = Electric shutoff (ELAB)

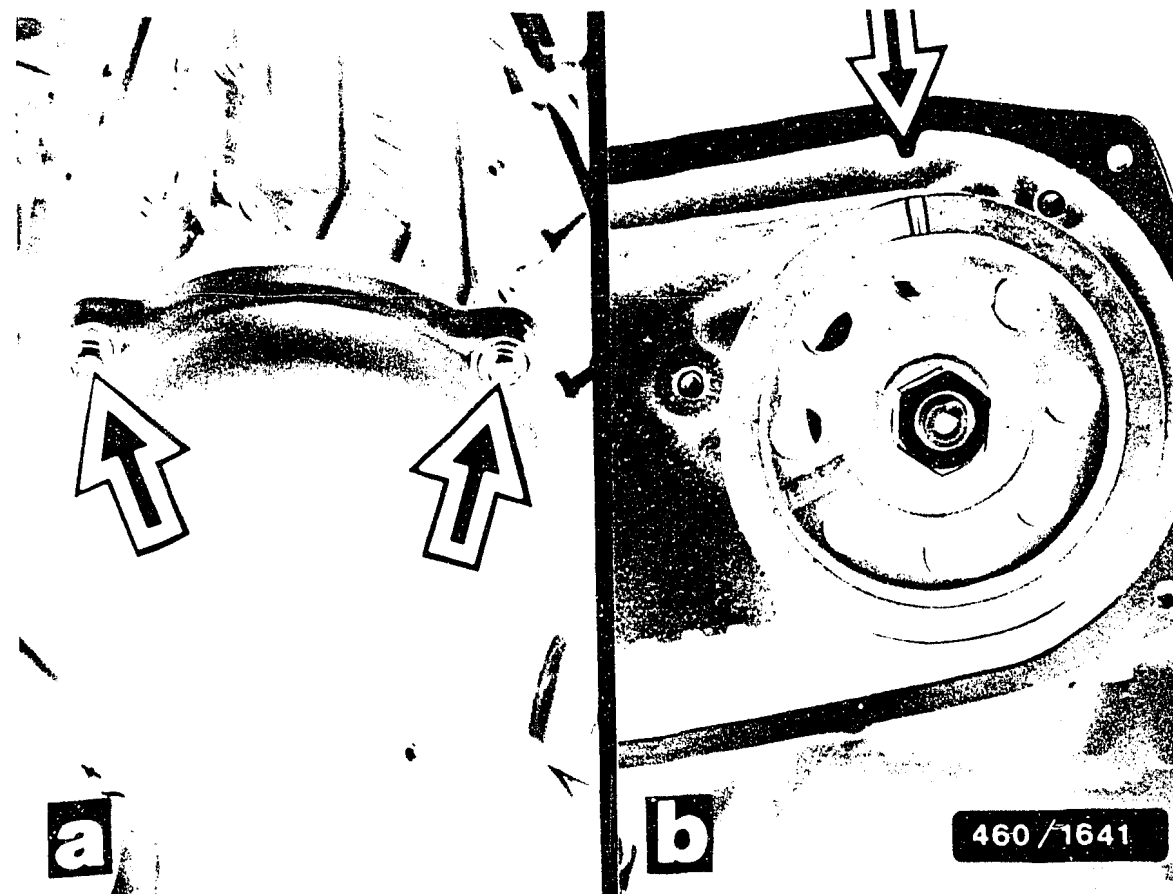
#### REMOVING FUEL-INJECTION PUMP

Disconnect the negative cable from the battery. Remove the bowden cable (accelerator pedal) and fuel supply line (Fig. a). Remove the electrical connection cable (ELAB), pressure line (LDA), and fuel-injection tubing (Fig. b).



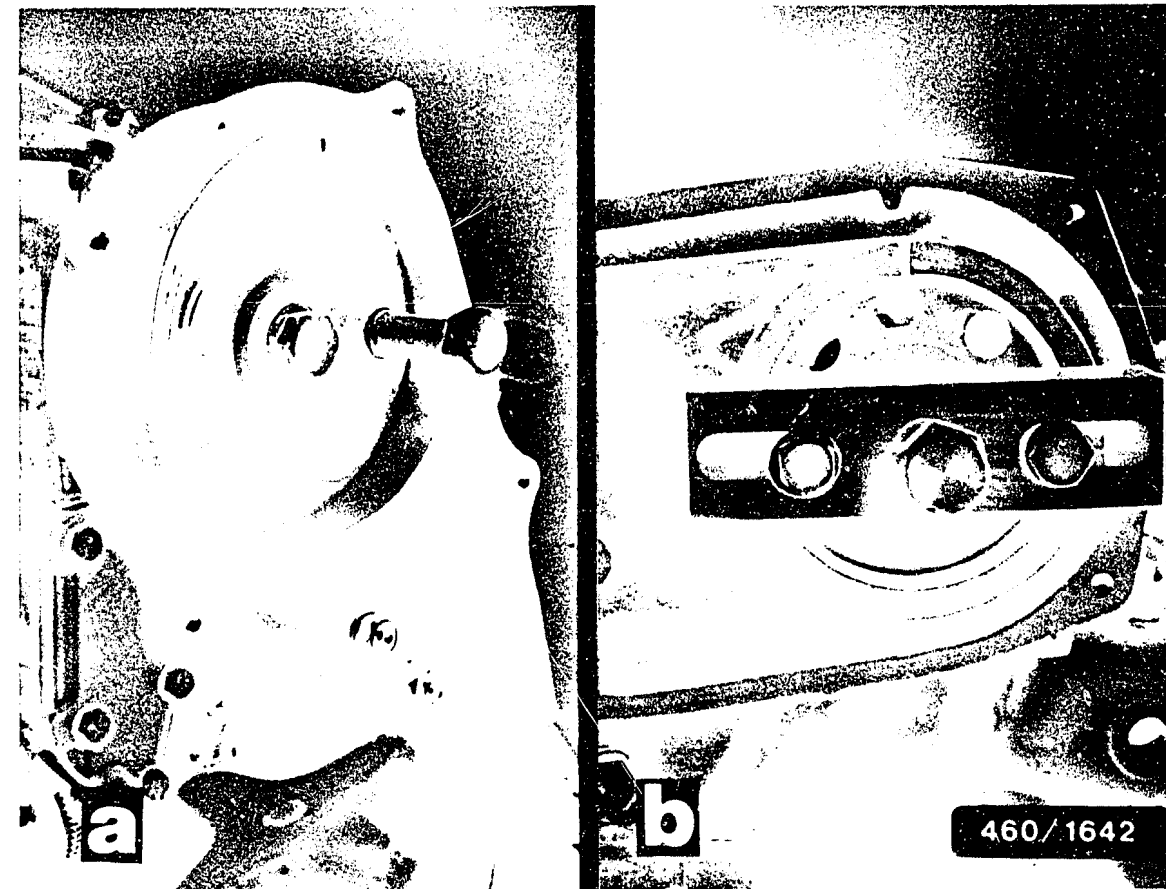
- 1 = Inlet-union screw
- 2 = Oil return line
- 3 = Bowden cable (KSB)
- 4 = Vacuum pump

Remove inlet-union screw.  
Loosen hose clamp and pull off oil return hose.  
Disengage bowden cable (KSB) (Fig. a).  
Remove the 2 vacuum-pump fastening bolts.  
Turn the engine until the vacuum pump can be pulled out of the opening in the cover (arrow).  
Remove the 6 fastening screws from the cover and remove cover (Fig. b).



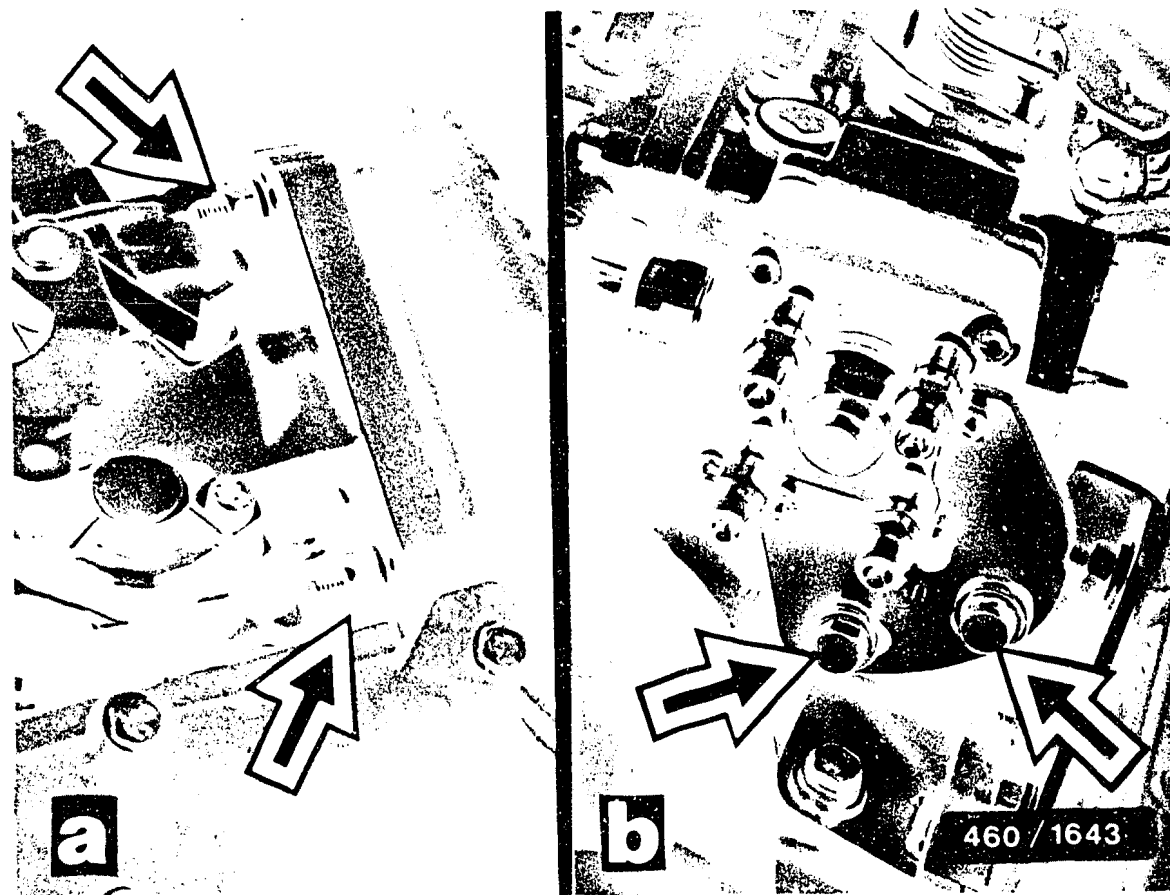
Remove the 4 fastening screws from the camshaft-drive toothed-belt protection cover (Fig. a).

Align adjusting marks (Fig. b).

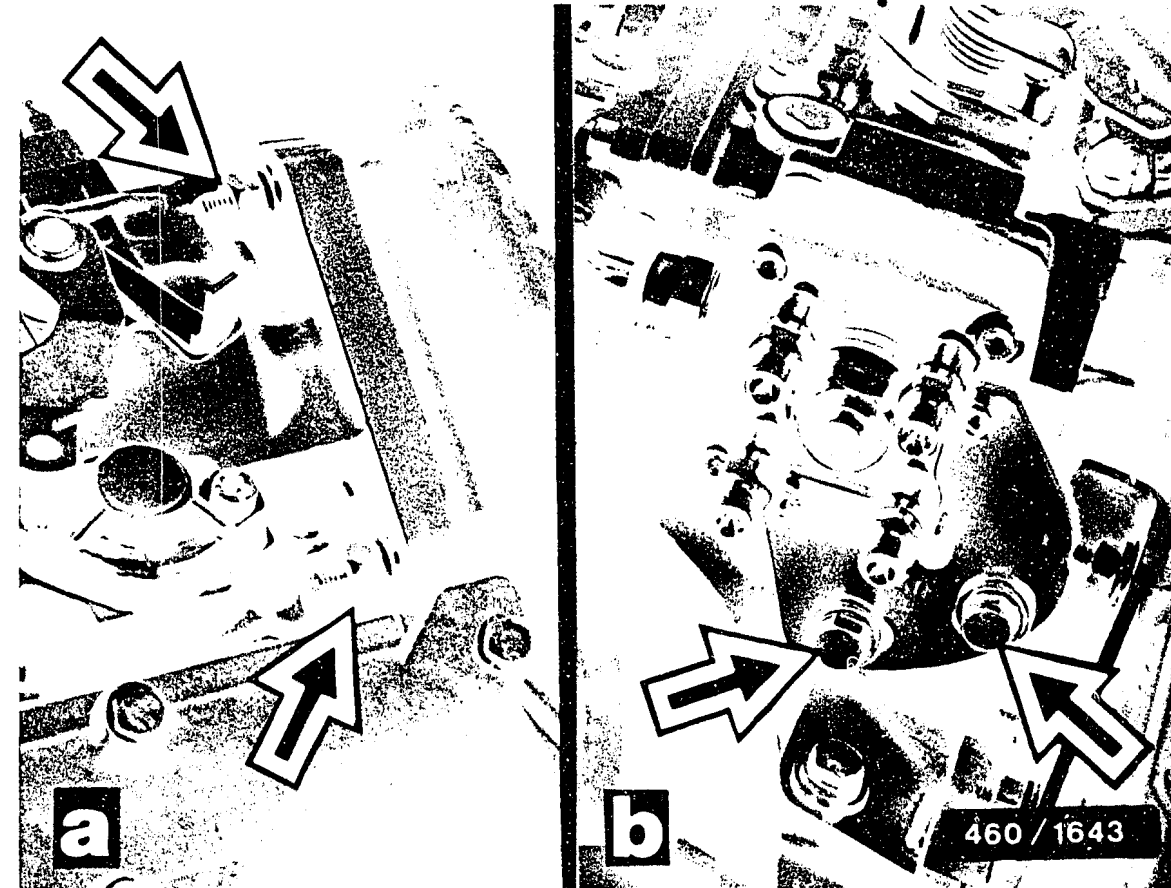


Lock the belt gear on the camshaft using Flat tool 1 860 473 000 (Fig. a).

Remove nut.  
Position tool KDEP 1118 and pull the belt gear from the fuel-injection pump shaft end (Fig. b).



Remove the 3 fastening nuts on the fuel-injection pump flange (Fig. a - arrows) and fastening screws of supporting plate (Fig. b - arrows).



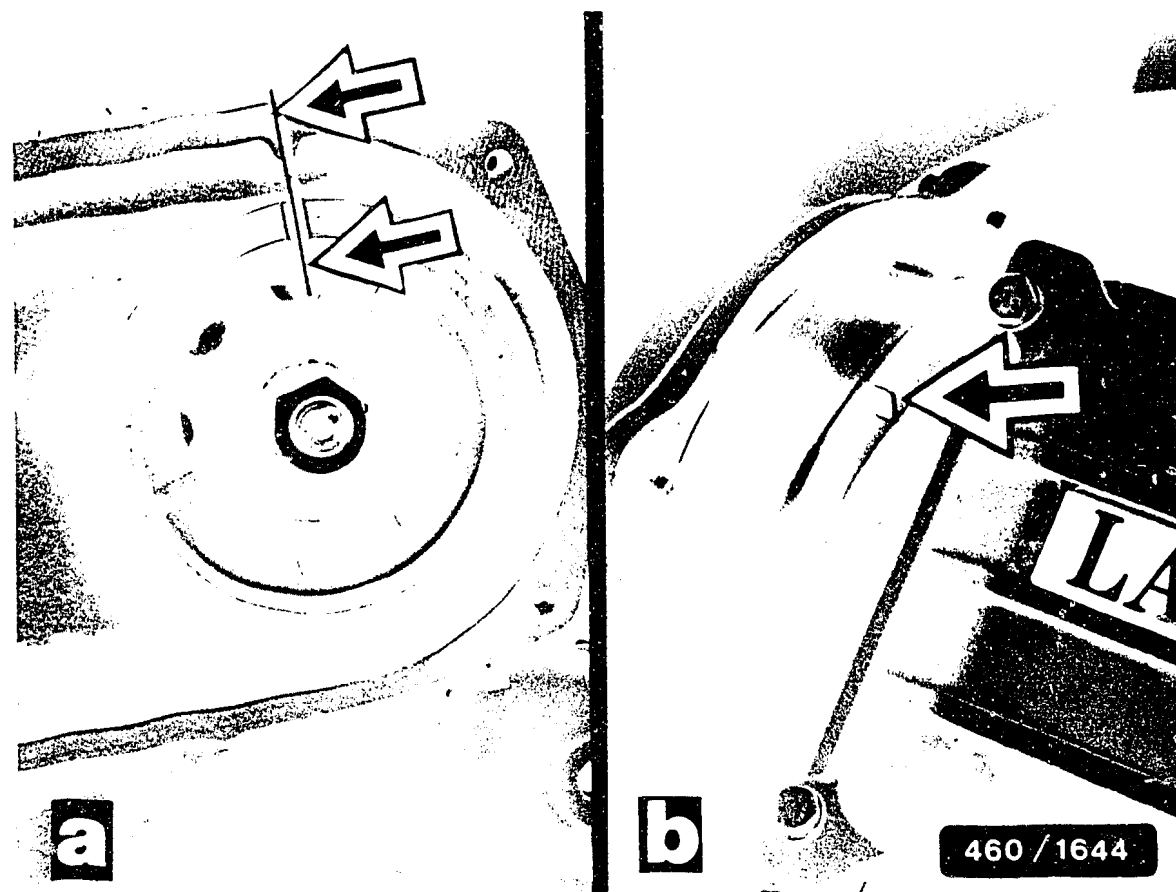
#### INSTALLING FUEL-INJECTION PUMP

Insert fuel-injection pump into housing.

The stay bolts are in the middle of the slots in the fuel-injection pump flange.

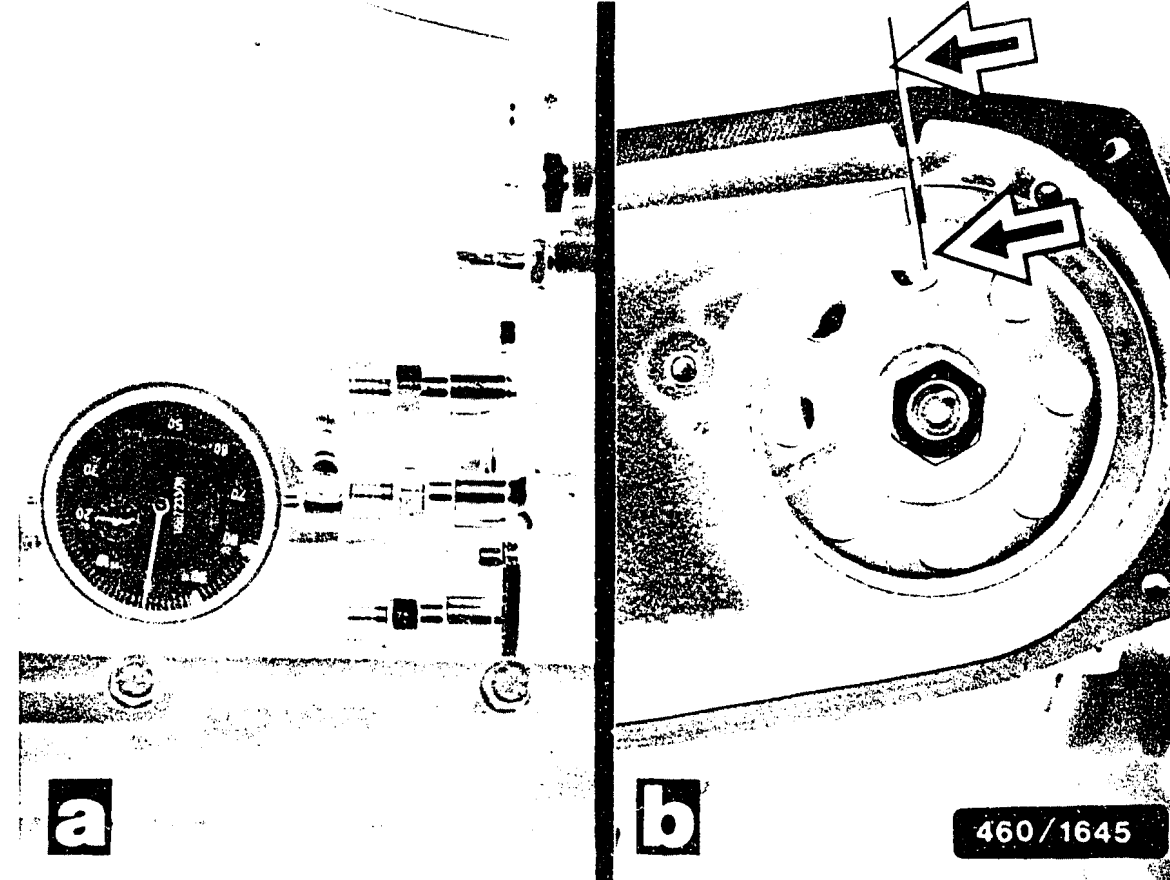
Loosely tighten 3 nuts (Fig. a - arrows).

Loosely tighten the fastening screws for the support plate (Fig. b - arrows).



Place the belt gear on the fuel-injection pump shaft end.  
Tighten the nuts by hand.  
Loosen the nuts by 2 turns. Pull belt gear away against the nuts. Put on the toothed belt. Bring the adjusting marks into alignment (Fig. a). Do not damage spring!

Check adjustment (marks on Fig. a and Fig b must be in alignment).  
Tighten nuts to 49 Nm.  
Remove threaded pin (Fiat part no. 1 860 473 000).



Remove the bleeder screw. Mount measuring device KDEP 1085 (Fig. a).  
Turn engine against its direction of rotation until the dial indicator indicates BDC of the pump piston.  
Set dial indicator to zero.  
Turn the engine in its direction of rotation until the setting marks are aligned (Fig. b).  
The dial indicator must show a value of 1 mm.  
If not, correct by slewing the fuel-injection pump.

Note:  
Poor tension on the part of the toothed belt for camshaft drive impairs pump adjustment.

\* Testing setting:

Turn the crankshaft 1 3/4 turns in direction of rotation.

Check whether dial indicator is to "0" in BDC position of pump piston.

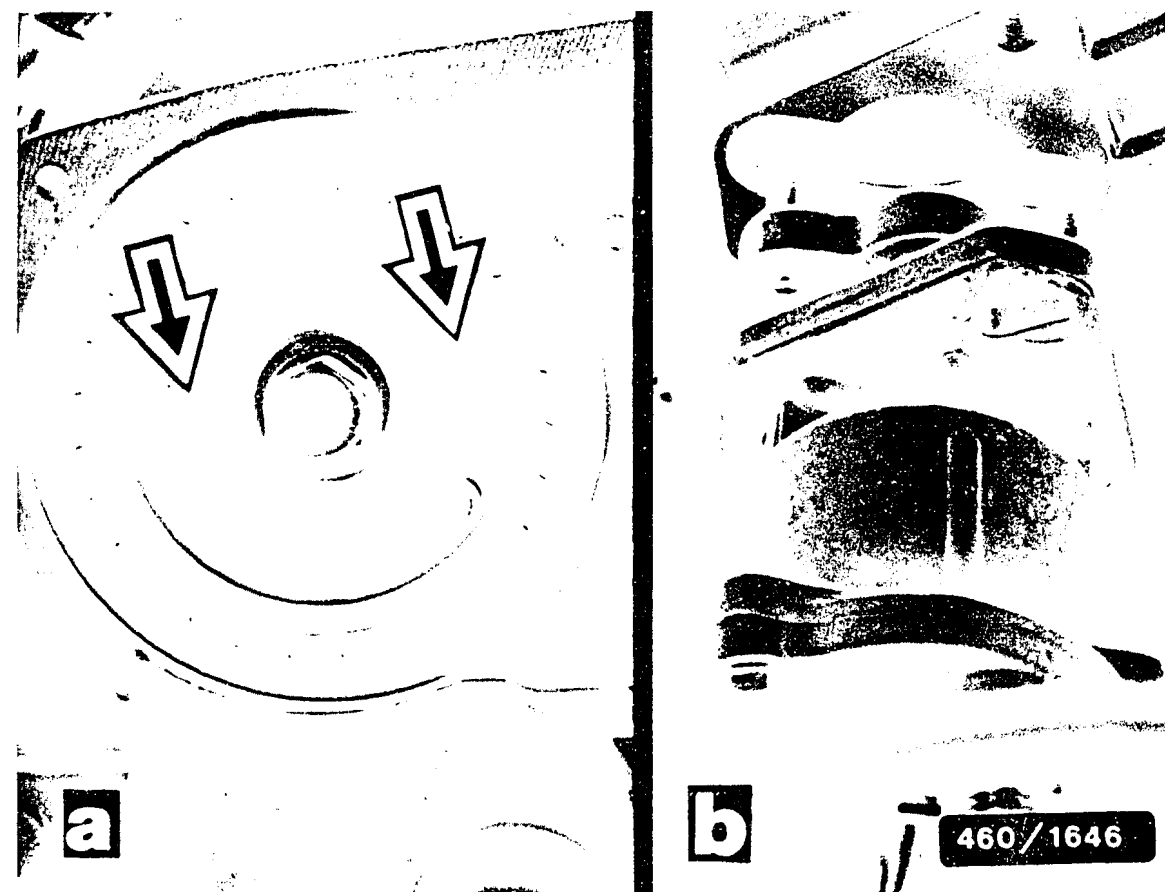
Turn crankshaft further until TDC position (engine) is reached. The dial indicator on the

fuel-injection pump must show a piston stroke of 1 mm.

Tighten fastening nuts to 23 Nm. Remove measuring device KDEP 1085 and screw in bleeder plug with new copper seal ring.

Tighten the fastening screws on the support plate to 23 Nm.

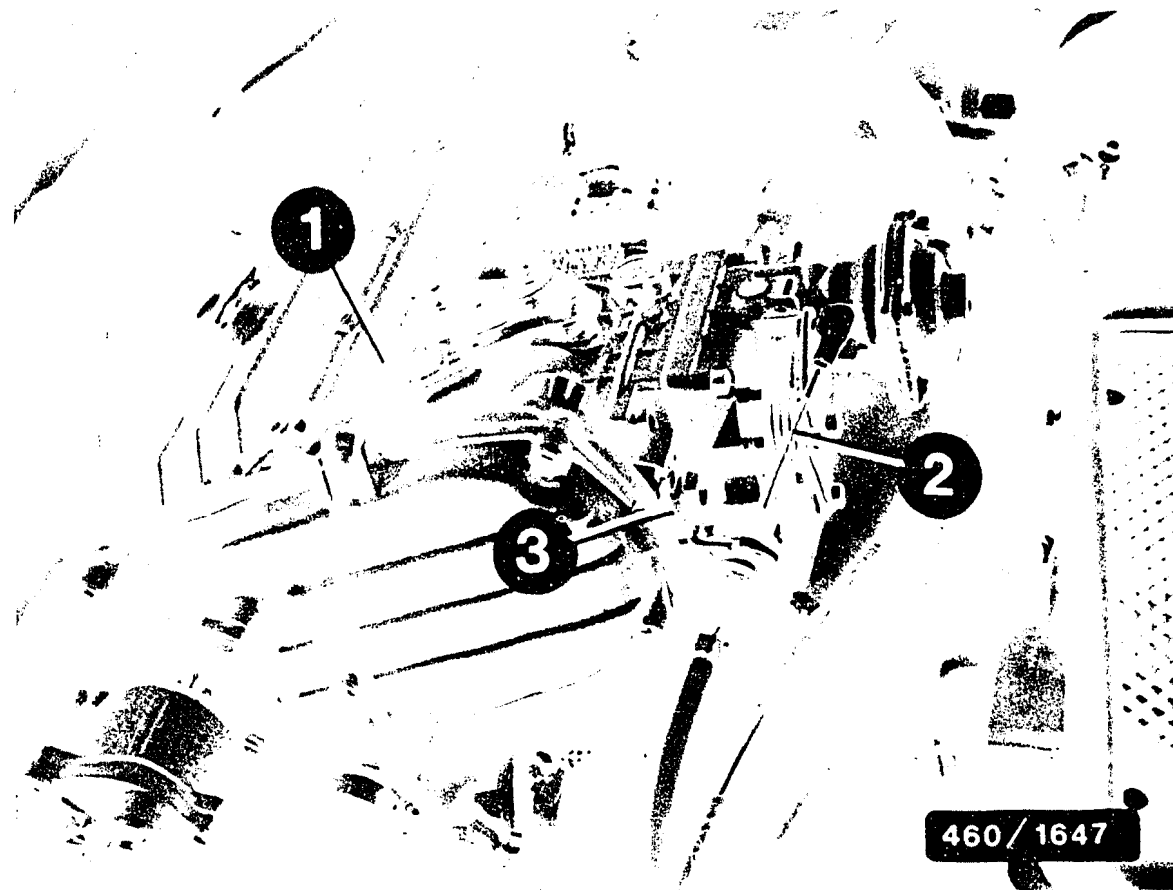
Mount the camshaft-drive toothed-belt protection cover.



Install the fuel-injection pump drive housing cover.

Turn the engine in its direction of rotation until both damping elements of the belt pulley are visible in the cover opening (arrows). Insert and tighten vacuum pump.

Mount the oil return hose, lubricating oil supply line with union nut (use new copper seals).



- 1 = Bowden cable (KSB)
- 2 = Bowden cable (accelerator pedal)
- 3 = Fuel supply line

Install fuel supply line (use new copper seals).

Install bowden cables for KSB and accelerator pedal.



- 1 = Pressure line (LDA)
- 2 = Fuel return lines
- 3 = Electrical connection cable (ELAB)

Connect pressure line (LDA) and connecting cable (ELAB).

Install fuel return lines (use new copper seal rings); the inlet-union screw is marked "OUT".

Install fuel-injection tubing.



**a**



**b**

460/1649

## TESTING AND ADJUSTING ENGINE TIMING

Put car in gear.  
Raise car and remove right front wheel.  
Take away the cover (Fig. a - arrow) in the wheel well.

Bring the markings on the belt pulley and cover of the camshaft drive into alignment (Fig. b - arrow).



**a**



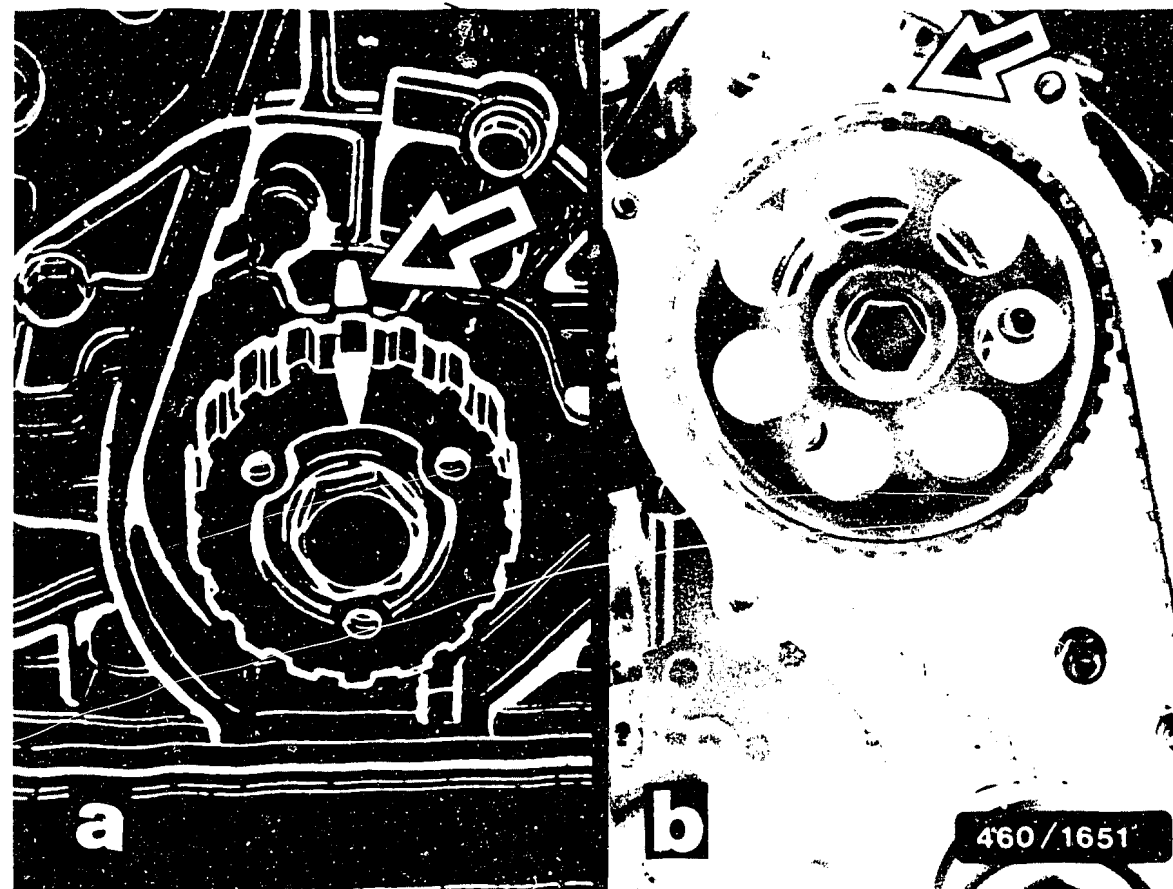
**b**

460/1650

Remove the 4 fastening screws from the camshaft-housing cover (Fig. a).

The line on the belt pulley must be in alignment with the hole marking on the camshaft housing (Fig. b).

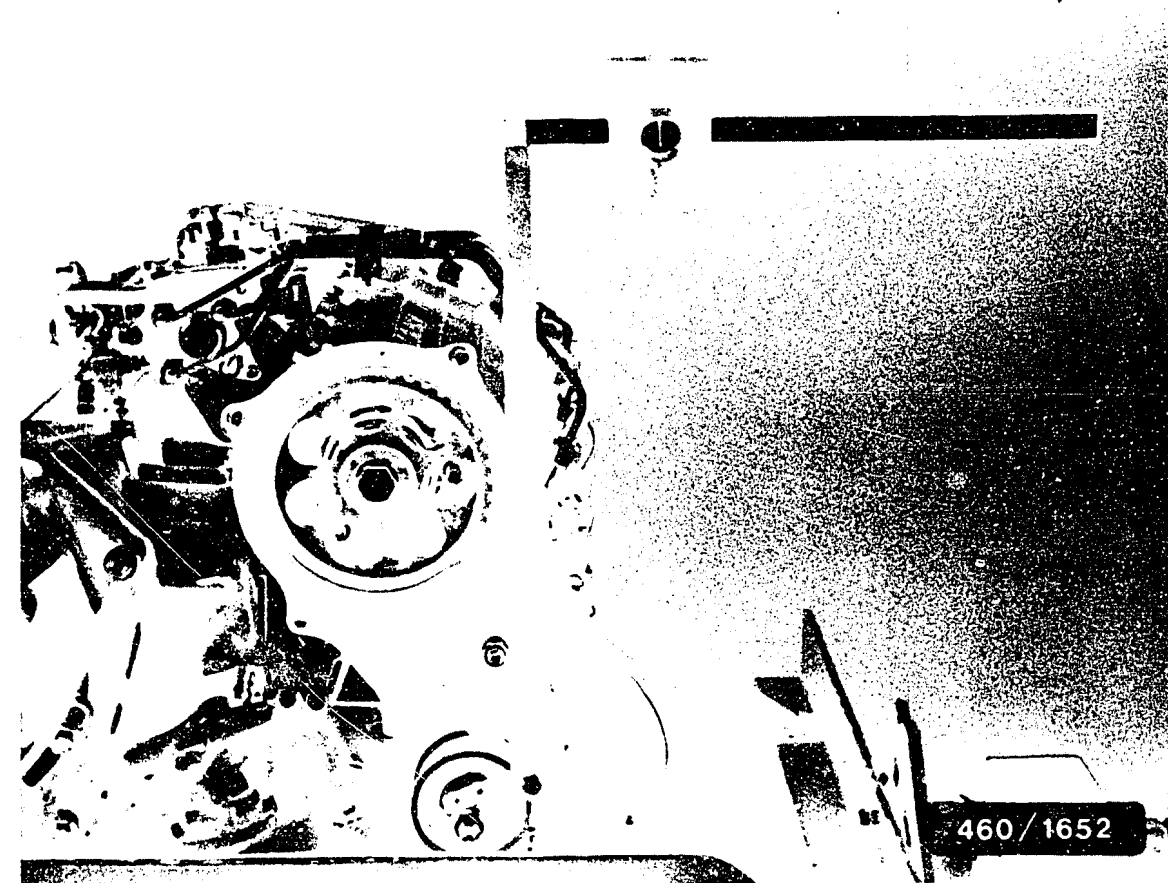




### Adjusting engine timing

Remove the cylinder-head cover. Bring crankshaft into TDC of 1st cylinder by turning right front wheel (4th cylinder is then at valve overlap). Remove the V-belt and belt pulley. Loosen the tensioning roller and remove the toothed belt.

Align the marks on the belt gear and bearing end plate (Fig. a - arrow) and marks on the belt gear and camshaft housing (Fig. b - arrow).



Put on the toothed belt.

Place FIAT tool 1 860 745 100 or 1 860 745 200 on the tensioning device.

Set weight to value of 65 mm.

Turn the engine two revolutions in direction of rotation. The adjusting marks must be in alignment. Tighten tensioning-device nuts to 44 Nm.

Mount the belt pulley and V-belt, and tension. Replace the cylinder-head cover and cover of camshaft drive.

Check the coordination of the pump and engine.

Setting value: pump position 1 mm after BDC.

Trouble-shooting instructions : MB-5046

BOSCH system : M-pump with RSF governor

Make of vehicle : MB

Basic microcard : FZD-00..

T A B L E O F C O N T E N T S

Section	Coordinate
Special features, usage.....	02
Test specifications.....	03
Testers and tools.....	04
Routing of vacuum lines Type 201.....	05
Routing of vacuum lines Type 124.....	07
Electrical terminal diagram.....	09
Trouble-shooting chart.....	11
Self-diagnosis by way of flashing-code evaluation..	13
Self-diagnosis test program.....	14
Component:	
Engine-speed sensor.....	17
Water temperature sensor.....	19
Servo magnet for idle-speed regulation.....	21

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes-Benz models.

- 190 D 2.5 Turbo (Type 201.128)
- 250 D Turbo (Type 201.128)
- 300 D Turbo (Type 124.133)
- 300 D Turbo (Type 124.333) 4Matic
- 9.87 ->

Engine: 602.961-USA with flashing-code diagnosis  
Idle-speed regulation (ELR)  
603.960-USA without flashing-code diagnosis\*  
603.963-ECE without flashing-code diagnosis\*  
with automatic transmission

\* Note:

The 603 engine is to be provided at a later date with the control unit for flashing-code diagnosis. The individual components of the idle-speed regulation system are to be tested in accordance with the flashing-code evaluation sequence.

The fuel-injection system differs as follows from that of the 603.912 engine.

- Absolute metering manifold-pressure compensator (ALDA).
- Exhaust turbo-supercharger

USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart gives an indication of various possible causes/component faults.

Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

## TEST SPECIFICATIONS

Idle speed:

Engine	Regulated min <sup>-1</sup>	Unregulated min <sup>-1</sup>
602.961	660...700	580...660
603.960	610...650	530...610
603.963	660...700	530...610

Test vacuum control valve:

Set value:

Engine 602: 395...445 mbar

Engine 603: 360...410 mbar

Test charge-air pressure under load:

at  $n = 4000 \text{ min}^{-1}$  0.75...0.95 mbar

Adjust mechanical features of speed regulation:

Engine: 602.961

Tempomat connecting rod 247...263 mm

Automatic-transmission idle-motion rod 189...205 mm

Fuel-injection-pump connecting rod 211...227 mm

Engine: 603.96.

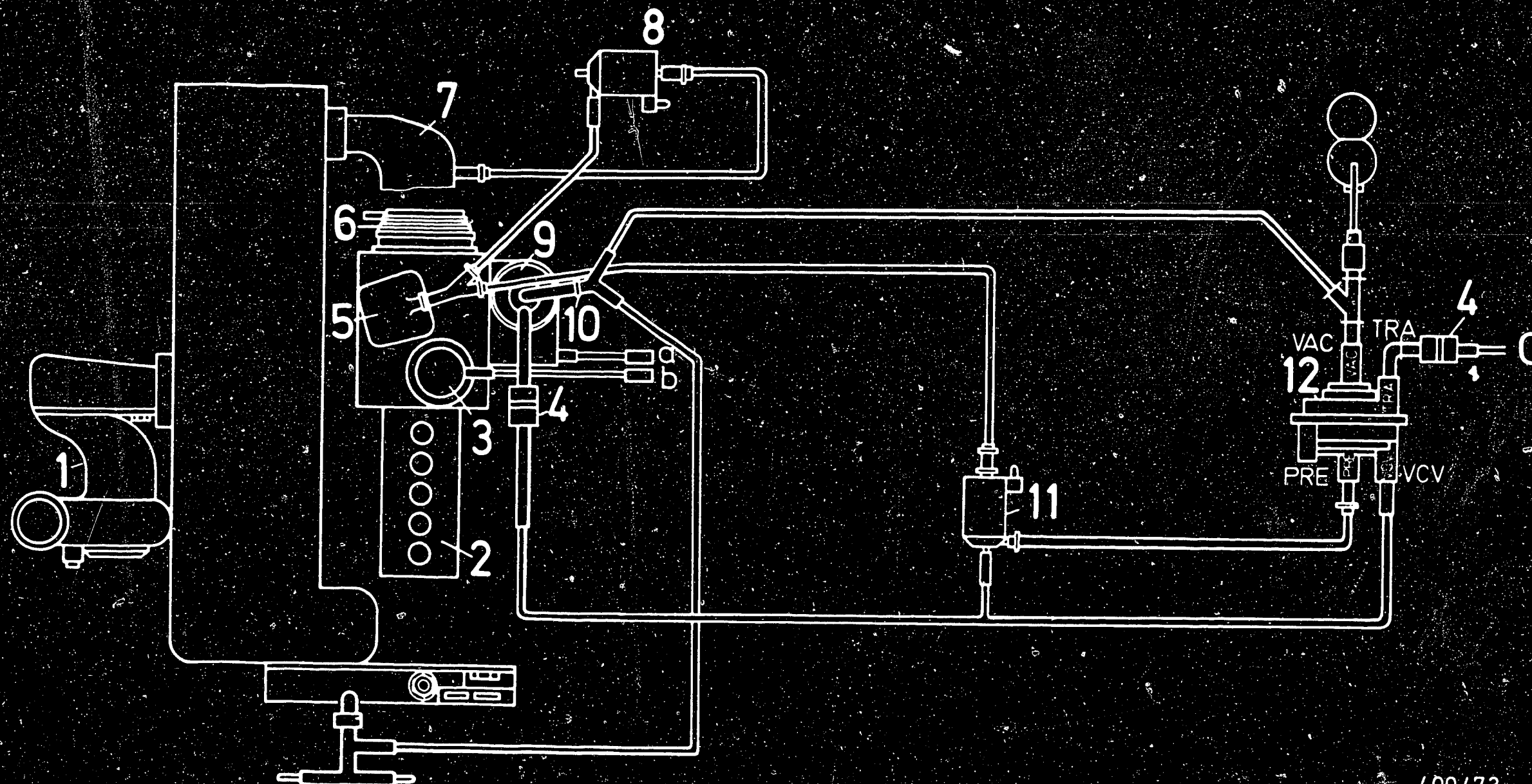
Tempomat connecting rod 93...109 mm

Axial-shaft connecting rod 112...128 mm

Fuel-injection-pump connecting rod 146...162 mm

## TESTERS AND TOOLS

Name	Designation	Part no.
Evaluation unit for flashing-code diagnosis		KDAW 9980
Ohmmeter	ETE 014.00	0 684 101 400
Voltmeter	ETE 014.00	0 684 101 400



400/73

- 1 = Turbocharger
- 2 = Fuel-injection pump
- 3 = Vacuum unit - stop
- 4 = Damper
- 5 = ALDA unit
- 6 = Idle-speed-regulation servo magnet
- 7 = Charge pipe
- 8 = Change-over valve, engine overload protection
- 9 = Vacuum control valve
- 10 = Throttle
- 11 = Change-over valve, pressure converter

12 = Pressure converter

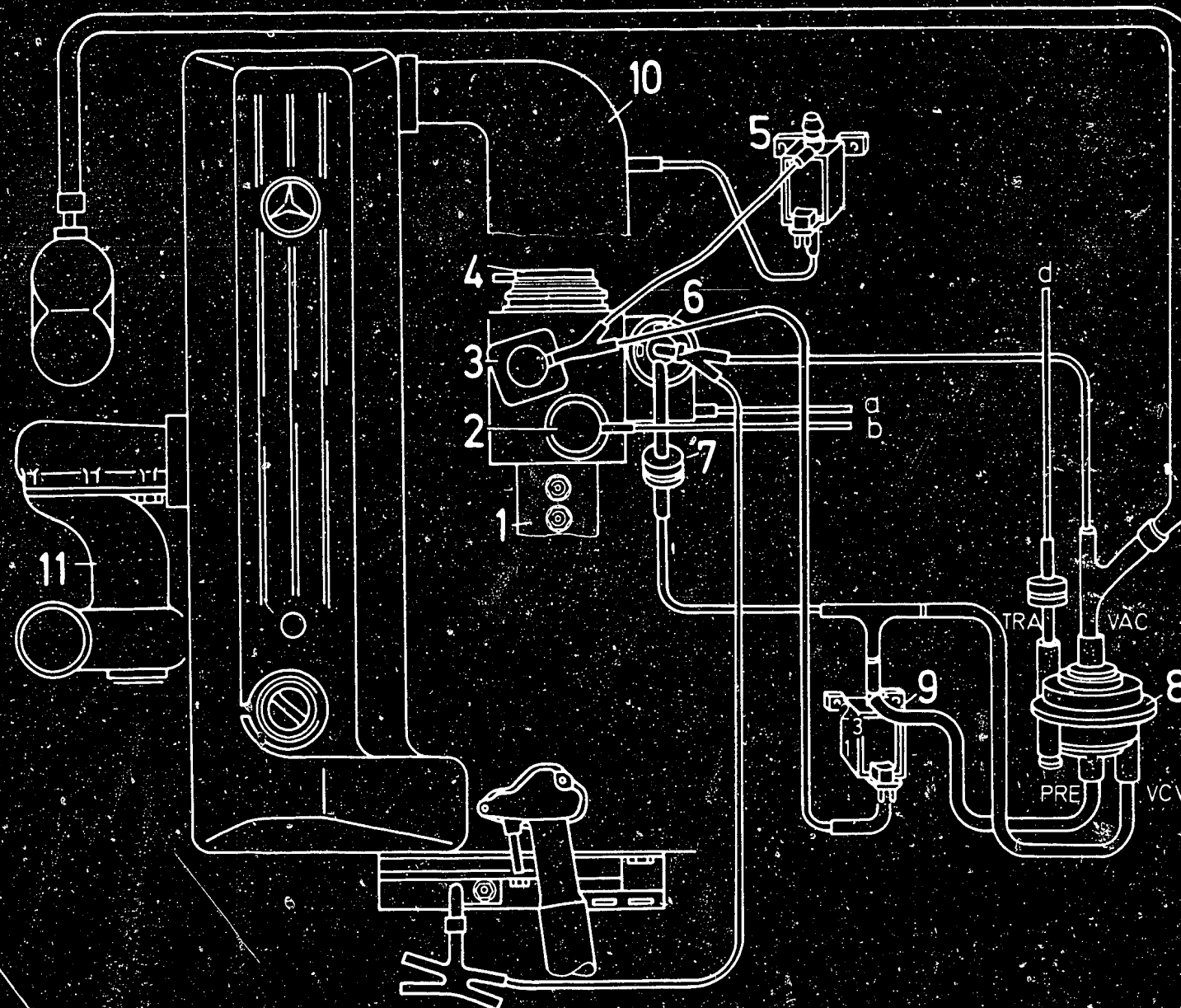
- a = Passenger-compartment ventilation
- b = Key shutoff
- c = to vacuum unit, automatic transmission

- PRE = Charge-air pressure
- TRA = Transmission
- VAC = Vacuum supply
- VCV = to vacuum control valve

VACUUM-LINE DIAGRAMS Routing of vacuum lines Type 201

G05

G06

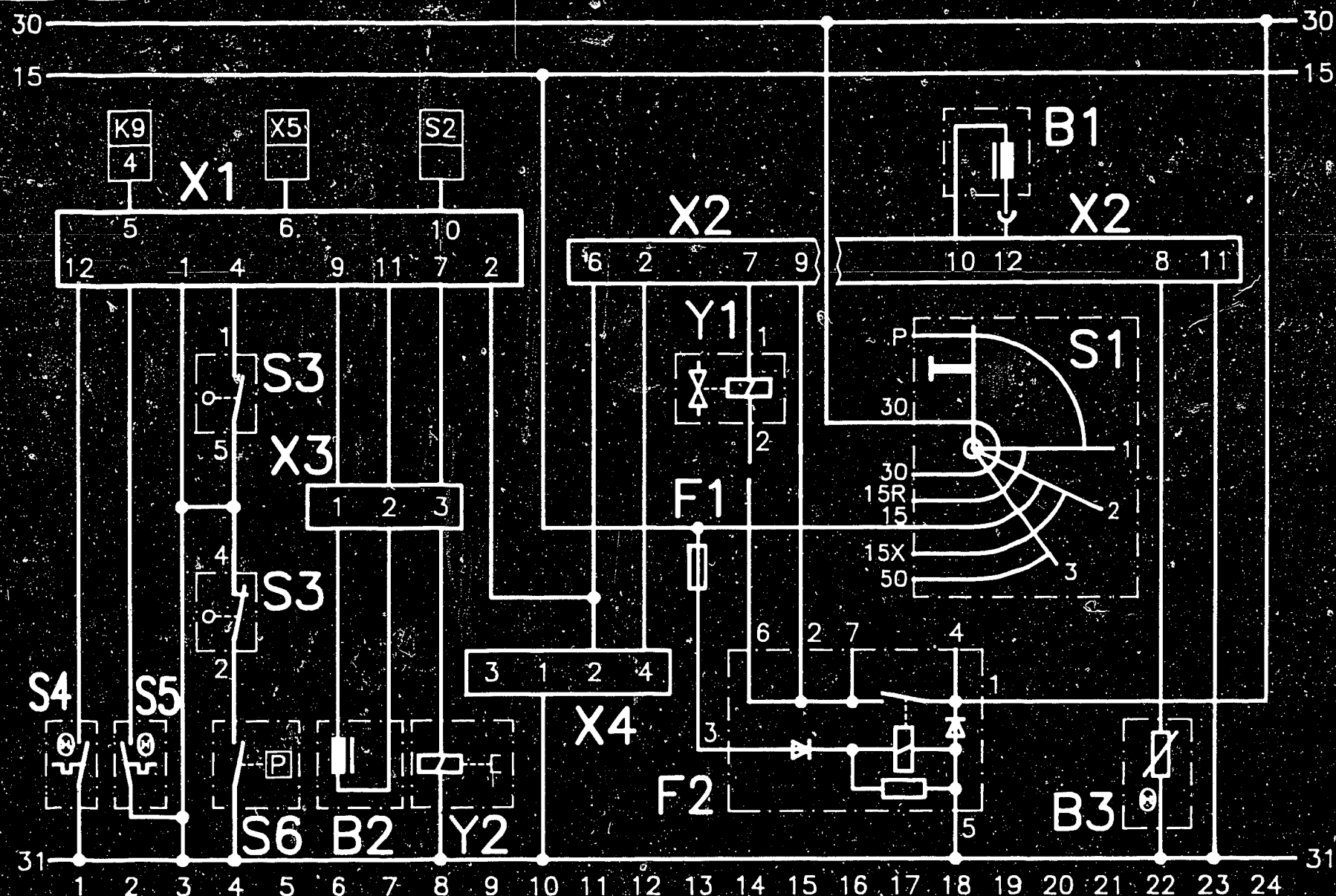


- 1 = Fuel-injection pump
- 2 = Vacuum unit - stop
- 3 = ALDA unit
- 4 = Idle-speed-regulation servo magnet
- 5 = Change-over valve, engine overload protection
- 6 = Vacuum control valve
- 7 = Damper
- 8 = Pressure converter
- 9 = Change-over valve, pressure converter
- 10 = Charge distributor
- 11 = Turbocharger

- a = Passenger-compartment ventilation
- b = Key shutoff
- d = to vacuum unit, automatic transmission

- PRE = Charge-air pressure
- TRA = Transmission
- VAC = Vacuum supply
- VCV = to vacuum control valve

VACUUM-LINE DIAGRAMS Routing of vacuum lines Type 124



- |       |  |    |   |
|-------|--|----|---|
| B1    | = Engine-speed sensor, starting-motor ring gear    | S4 | = Temperature switch 105/115°C                |
| B2/Y2 | = Refrigerant compressor                           | S5 | = Temperature switch 105/115°C                |
| B3    | = Coolant temperature sensor                       | S6 | = Engine-overload-protection switch           |
| F1    | = Central electrics console                        | X1 | = Control unit, refrigerant-compressor cutoff |
| F2    | = Over-voltage protection                          | X2 | = Control unit, idle-speed regulation (ELR)   |
| S1    | = Glow-plug and starter switch                     | X3 | = Plug connection                             |
| S2    | = Pressure switch, refrigerant compressor          | X4 | = Test coupling for flashing-code diagnosis   |
| S3    | = Charge-air-pressure switch<br>-compressor cutoff | X5 | = Plug connection, lamp cable set             |
|       |  | Y1 | = Servo magnet, fuel-injection pump           |

ELECTRICAL TERMINAL DIAGRAM TYPE 201 ENGINE 602.961 WITH AUTOMATIC AIR CONDITIONER

## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Diagnosis lamp flashes (activation with KDAW 9980)
  2. Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
  3. Engine hunts when idling
  4. Idle not smooth with warm engine
  5. Idle speed too high/too low
  6. Engine missing when driving
  7. Inadequate engine power
  8. Engine bucks at full load
  9. Fuel consumption too high
  10. Engine doesn't switch off or not immediately
  11. Hard engine running
- Cause (component fault)

Cause (component fault)

[illegible]

## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

- 12. Black smoke in full-load range
- 13. Cloud of smoke in full-load range
- 14. Engine won't rev up when cold
- 15. Part-load bucking
- 16. Poor acceleration
- 17. Fuel-injection pump

Cause (component fault)

						Self-diagnosis
		*				Tank ventilation
*		*				Injection sequence
				*		Paraffin separation
		*				Air in fuel system
		*				Fuel lines leaking/clogged
		*		*		Supply lines clogged
*						Fuel-injection tubing clogged/constricted
*						Engine air filter
						Idle speed, mechanical
						Test idle-speed regulation (ELR)
			*	*		Test active bucking damping (ARD)
						Mechanical features of speed regulation
						Vacuum system
*	*			*		Injection nozzles
						Fuel filter/overflow restriction
						Supply pump
						Glow plug system
						Timing device
*	*					Engine compression
*	*					Pump/engine assignment
*	*	*	*	*	*	Fuel-injection pump

## FLASHING-CODE EVALUATION

Connect socket 3 of evaluation unit for flashing-code diagnosis KDAW 9980 to a fused positive lead.

Connect socket 4 to socket 1 of evaluation unit.

Connect socket 2 to socket 4 of diagnosis socket.

Start engine.

Actuate nonlocking switch (evaluation unit) for between 2 and 4 seconds.

Then keep nonlocking switch pressed.

Flashing code of corresponding faulty component is indicated.

Repeat flashing-code evaluation:

Briefly disconnect plug connection (socket 4, diagnosis socket).

Press nonlocking switch.

Scan flashing code.

## SELF-DIAGNOSIS TEST PROGRAM

-Engine 602.961

Breakdown of ELR self-diagnosis  
(flashing code)

- 1 x All functions O.K.
- 2 x Engine-speed sensor
- 3 x Coolant temperature sensor
- 6 x Idle-speed-regulation closed loop (ELR)\*

\* Only short-circuit faults are detected

-Engine 603. Perform component test in same sequence.

Test conditions:

-Coolant temperature 60...80°C

- Over-voltage-protection fuse O.K.

- Mechanical transmission:  
Battery voltage min. 11.5 V between socket 1 and 5 of over-voltage protection.

- Automatic transmission:  
Battery voltage min. 11.5 V. Selector lever in position "P".

- A/C off

- All plug connections made.

Idle speed:

Engine	Regulated min <sup>-1</sup>	Unregulated min <sup>-1</sup>
602.961	660...700	580...660
603.960	610...650	530...610
603.963	660...700	530...610



SELF-DIAGNOSIS TEST PROGRAM ( 1 )

V

Flashing code "2"  
Component: Engine-speed sensor  
In engine compartment next to battery

N

Engine-speed sensor defective,  
renew.

Test 1: Ground connection

Detach multiple butt connector from  
engine-speed sensor.  
Connect ohmmeter with commercially  
available test prods to one wiring  
post in each case and ground.

Set value:  $> 1\text{ M } \Omega$

Set value attained?

Y

V

Test 2: Internal resistance

N>

Engine-speed sensor defective,  
renew.

Detach multiple butt connector from  
engine-speed sensor.

Connect ohmmeter to pins of multiple  
butt connector.

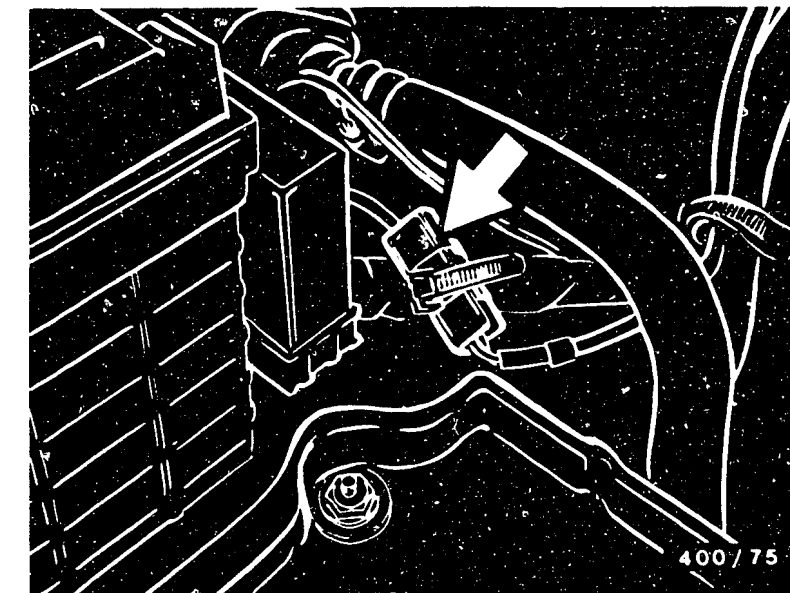
Set value:  $1.7...2.1\text{ K } \Omega$

Set value outside tolerance

Y

V

Continued on next picture page



Test 3:

Check to see whether engine-speed sensor is dirty.

N>

Check to see whether dirt has accumulated on engine-speed sensor and clean if necessary.  
Eliminate open-circuit in lead.  
Renew control unit.

Detach multiple butt connector from engine-speed sensor.  
Connect test lead to both wiring posts.

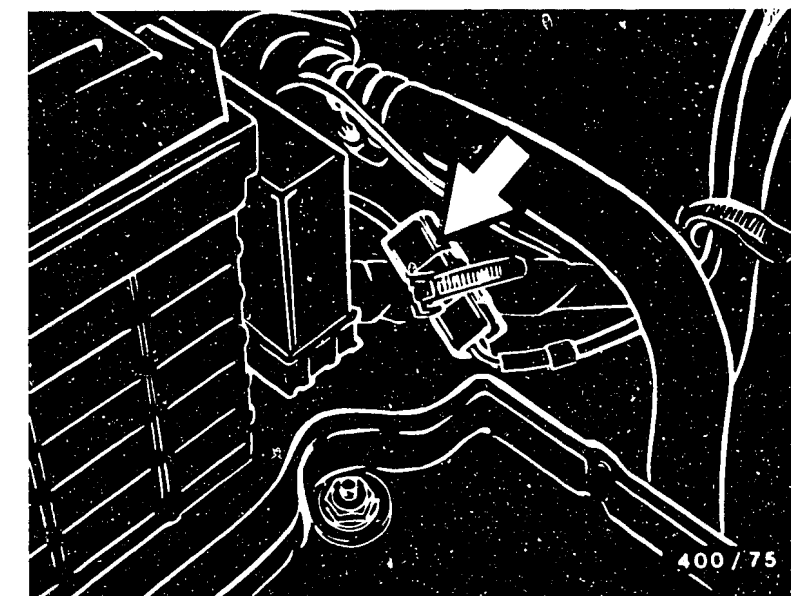
Allow engine to idle.

Set value : > 4 V AC

Note:

Voltage increases with increasing engine speed.

Is set value attained?



400 / 75

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# SELF-DIAGNOSIS TEST PROGRAM ( 2 )

Flashing code "3"  
Component: Water temperature sensor

N>

Water temperature sensor defective,  
renew.

Test 1: Resistance  
Engine switched off. Detach  
connector at temperature sensor.  
Test ohmmeter with test lead with  
respect to ground (top picture).

See diagram for set values.

Set value at:  
+ 20 °C = 2200...2800  $\Omega$   
+ 80 °C = 290...370  $\Omega$

Test 2: Voltage supply.

N>

Test for open-circuit in connector  
of water temperature sensor.

Detach connector at water  
temperature sensor.  
Connect voltmeter with commercially  
available test lead to 1-pole plug.  
Switch on ignition.

Set value approx. 5 V

Is set value attained?

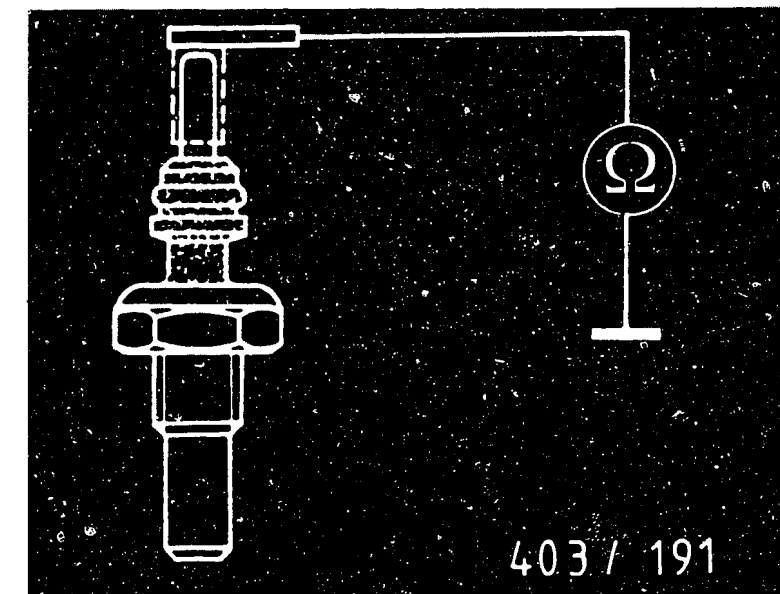
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G19

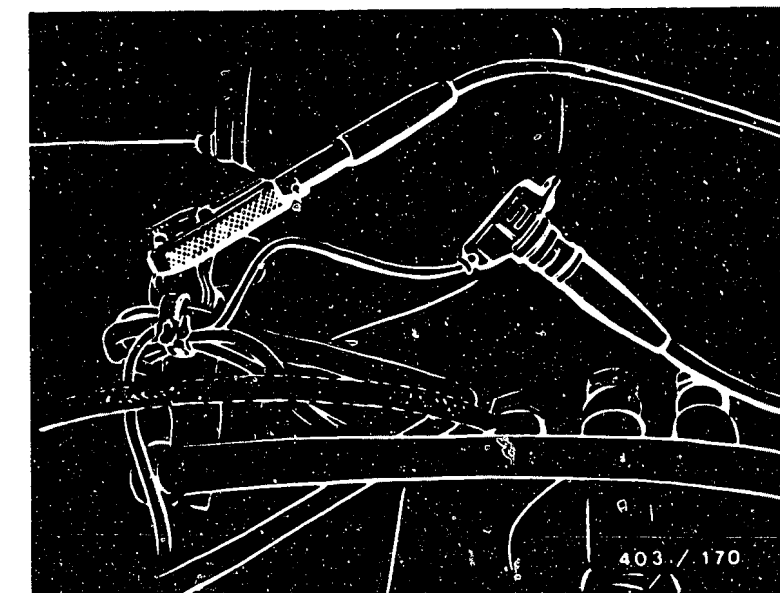
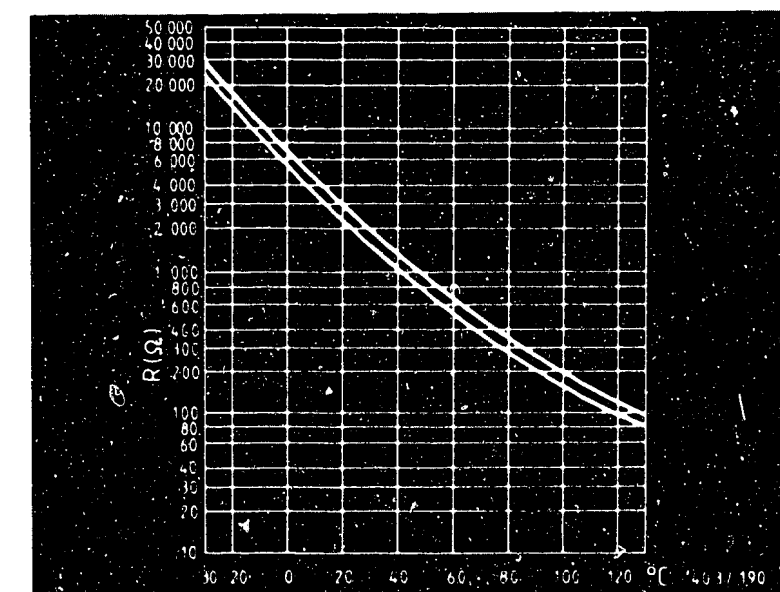
<=>

G20

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403 / 191



403 / 170

Flashing code: "6"

Component: Test idle-speed regulation (ELR)

Engine idling.

Regulated idle speed

Set values:

Engine 602.961: 660...700 min -1

Engine 603.960: 610...650 min -1

Engine 603.963: 660...700 min -1

Detach plug at servo magnet for at least 3 seconds.

On re-connection, idle speed briefly increases to in excess of regulated idle speed.

Does idle speed increase?

N>

1st test step

1. Detach plug at servo magnet; apply (see picture) 12 V for brief period (max. 3 seconds as otherwise servo magnet defective).

If there is no increase in idle speed:

Servo magnet defective - renew

Pay attention to shims when removing and installing.

2nd test step

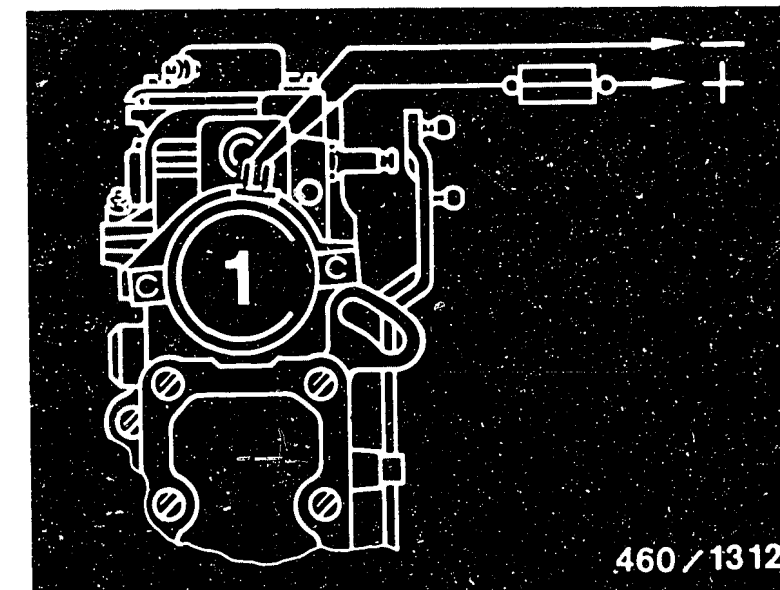
1. Engine switched off.

Use voltmeter to establish whether approx. battery voltage is being applied at both contacts of fuse at over-voltage protection.

Renew defective fuse.

2. Test for open-circuit in lead of engine multiple butt connector term. 30, plug-connection lead, engine compartment socket 1 and battery ground lead with respect to over-voltage protection term. 1, 5 and 3 in each case.

3. Test for open-circuit in lead from over-voltage protection term. 6 to servo magnet. Eliminate open-circuit.

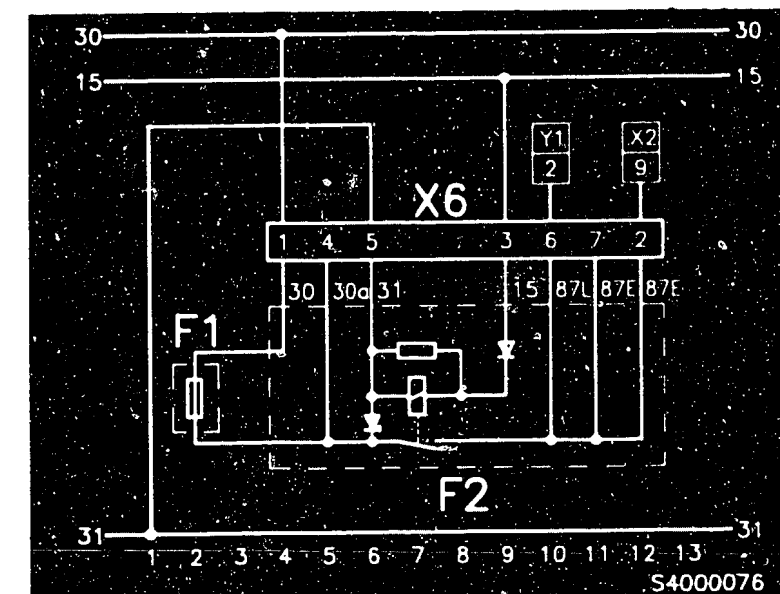


460 / 1312

X6 = Plug connection

F1 = Central electrics console

F2 = Over-voltage protection



Continued on next picture page

4. Detach ELR control unit.  
 Test for open-circuit in leads from control-unit base term. 11 to battery ground, from term. 8 to coolant temperature sensor, from term. 10 and 12 to engine-speed sensor and from term. 9 to over-voltage protection term. 2.  
 Eliminate open-circuit.

3rd test step

Attach control unit.  
 Engine idling.  
 Detach plug of servo magnet and test voltage at plug.  
 Set value: approx. 12 volts  
 If voltage is not attained

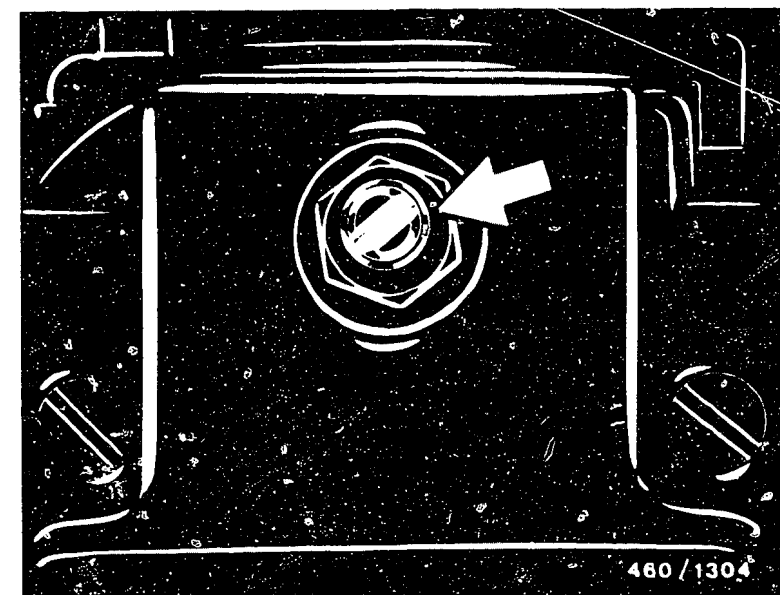
Renew ELR control unit

V

Test unregulated idle speed.  
 Plug at servo magnet detached.  
 Set values:  
 Engine 602.961: 580...660 min<sup>-1</sup>  
 Engine 603.960: 530...610 min<sup>-1</sup>  
 Engine 603.963: 530...610 min<sup>-1</sup>  
 Idle speed O.K.

N>

Loosen lock nut and adjust idle speed at idle-speed adjusting screw (arrow)



Trouble-shooting instructions : MB-5047

BOSCH system : M-pump with RSF governor

Make of vehicle : MB

Basic microcard : FZD-00..

T A B L E O F C O N T E N T S

Section	Coordinate
Special features, usage.....	02
Test specifications.....	03
Routing of vacuum lines.....	04
System overview, electrical/ pneumatic exhaust-gas recirculation.....	05
Electrical terminal diagram.....	07
Trouble-shooting chart.....	09
Testing EGR.....	11
Testing glow plug system.....	27

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes-Benz model

300 TD (Typ 124)  
9.87 ->

Engine: 603.912

Swiss version with EGR (exhaust-gas recirculation) system.

The fuel-injection system differs as follows from that of the 603.912 Std. engine:

- Altitude-pressure compensator (ADA)
- Exhaust-gas recirculation (pneumatic/electronic control).
- Glow-plug relay with after-glow and rod-type glow plugs.

USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart gives an indication of various possible causes/ component faults.

Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

TEST SPECIFICATIONS

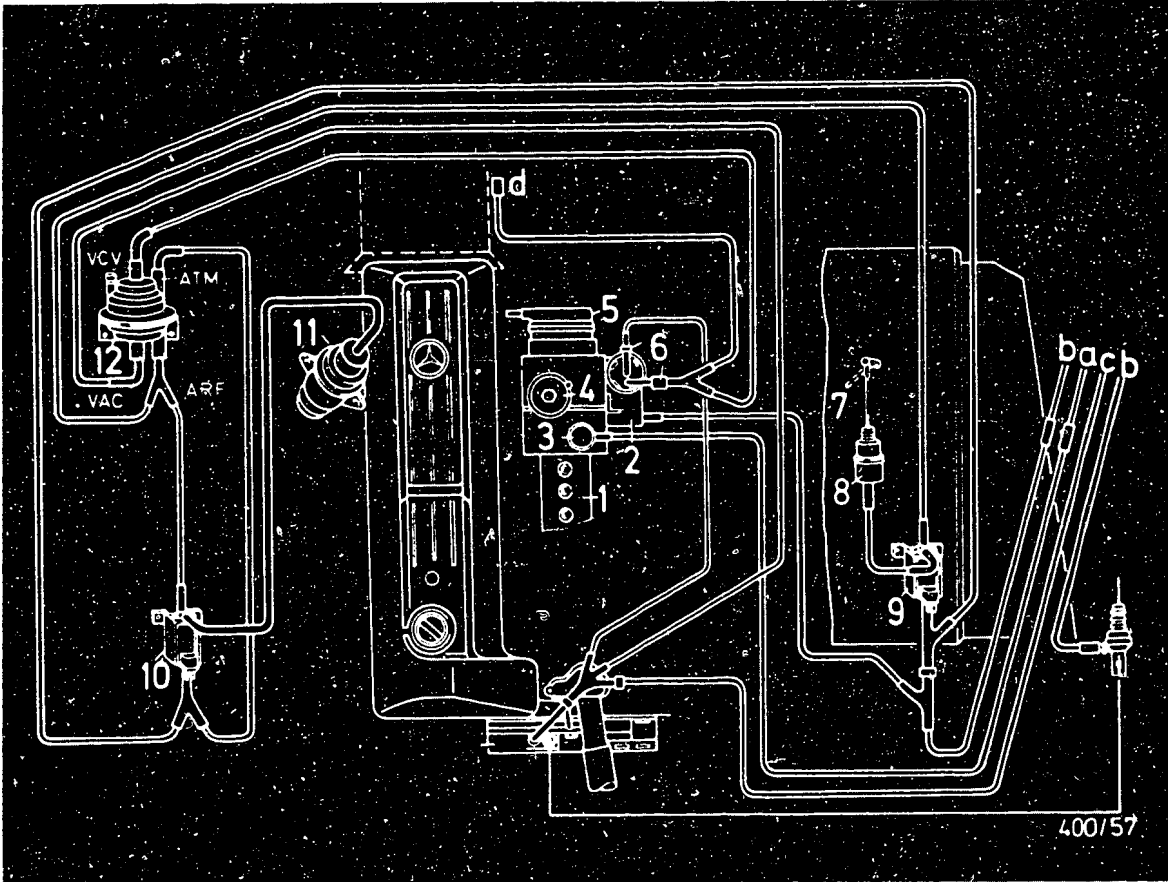
Idle speed:

Engine	Regulated	Unregulated
603.912	610...650	530...610

Vacuum control

- Vacuum values

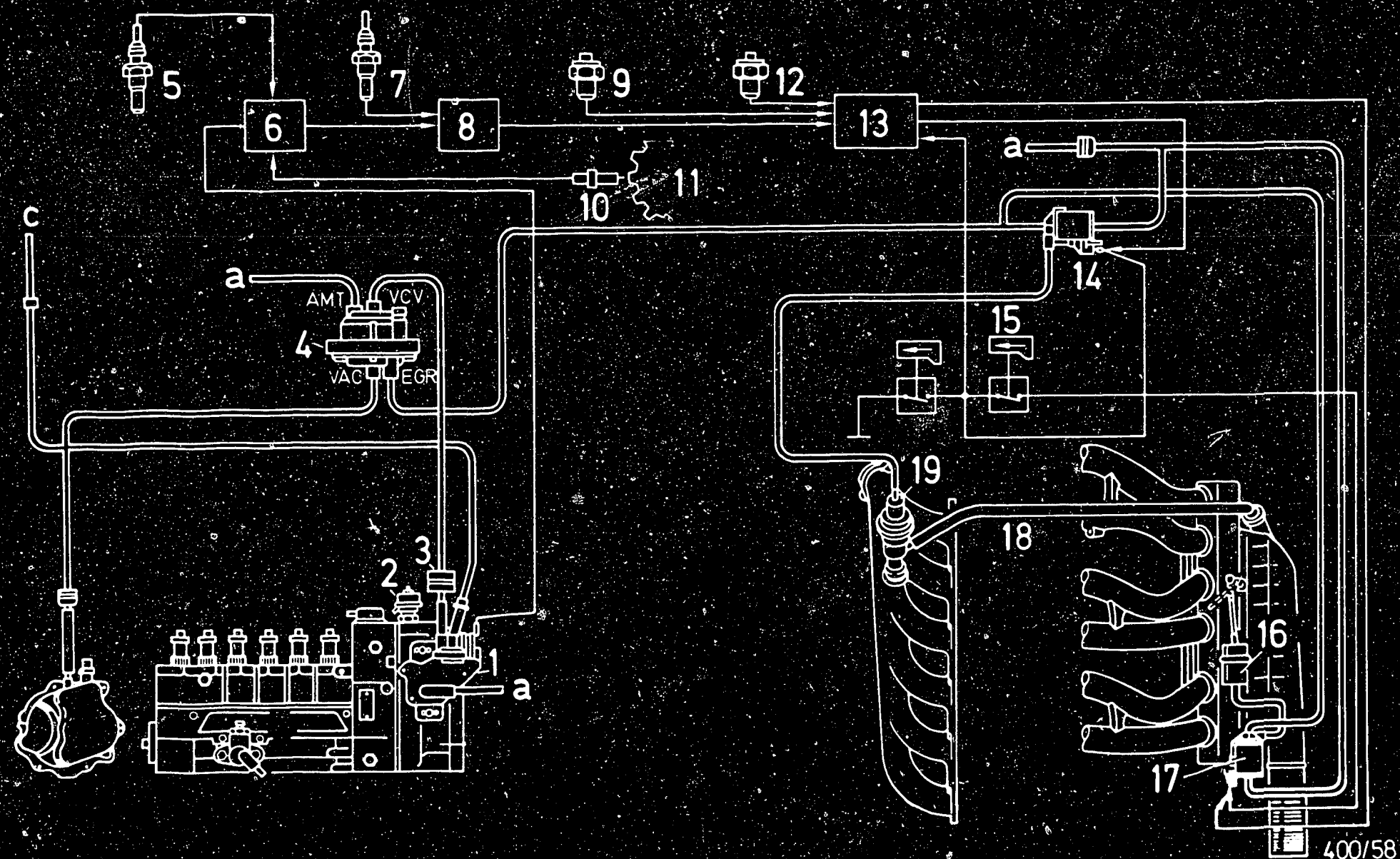
min-1	Pressure values	Pressure-control flap
610...650	0	Basic setting (open)
950...1050	150...360	Full energization (closed)
2450...2550	150...360	Basic setting (open)
2950...3050	0	Basic setting (open)



- 1 = Fuel-injection pump
- 2 = Vacuum control valve
- 3 = Vacuum-unit stop
- 4 = ADA unit
- 5 = Idle-speed-regulation servo magnet
- 6 = Throttle (blue)
- 7 = Pressure-control flap
- 8 = Vacuum unit/pressure-control flap
- 9 = Change-over valve, pressure-control flap
- 10 = Change-over valve, EGR
- 11 = EGR valve
- 12 = Pressure converter

- a = Passenger-compartment ventilation
- b = Key shutoff
- c = Load
- d = Automatic-transmission vacuum unit
- VCV = to vacuum control valve
- VAC = Vacuum supply
- ATM = Passenger-compartment ventilation
- ARF = to EGR valve

ROUTING OF VACUUM LINES Type 124  
-Engine 603.912 Swiss version



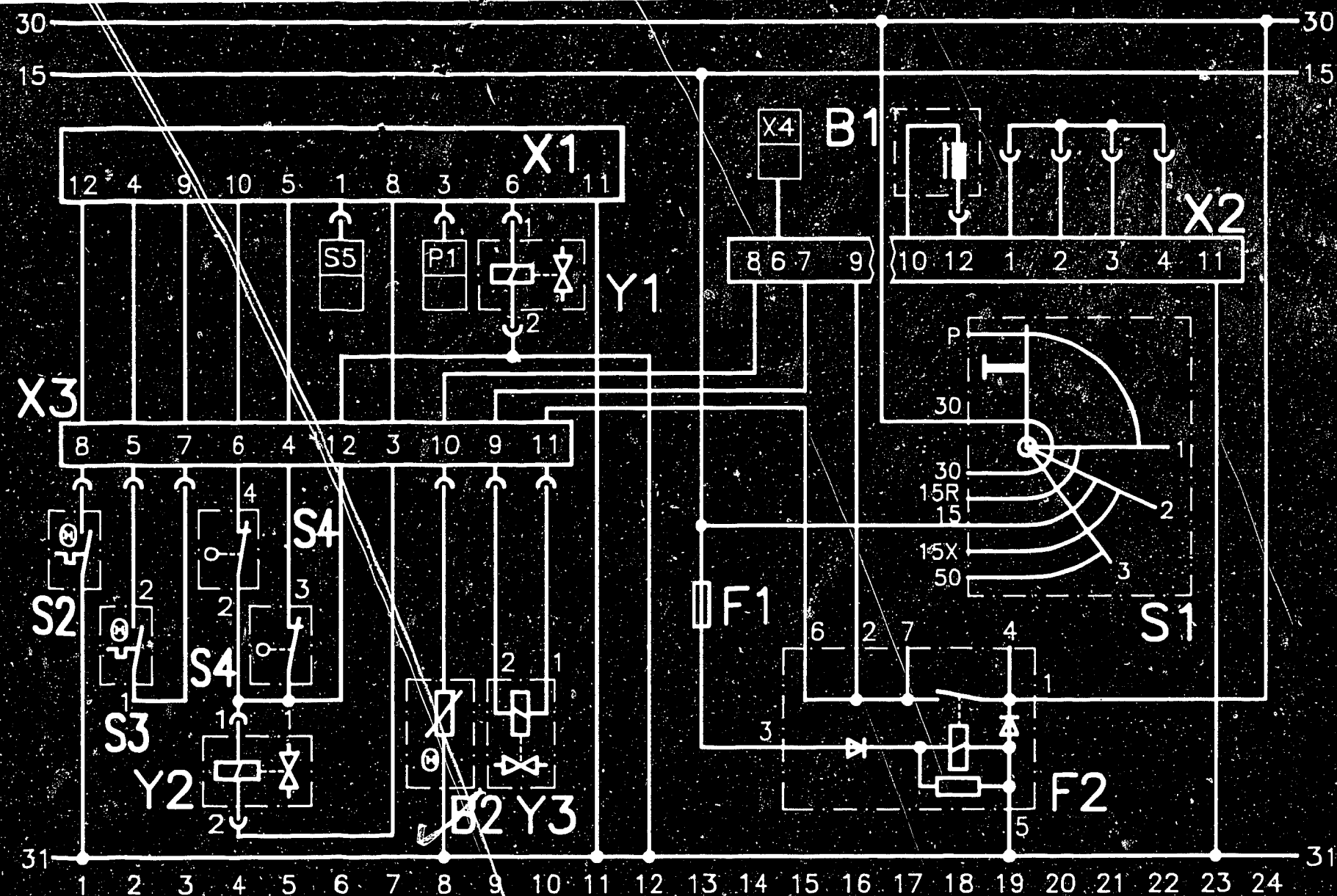
- 1 = Vacuum control valve
- 2 = ADA unit
- 3 = Damper
- 4 = Pressure transducer
- 5 = Coolant temperature sensor
- 6 = Idle-speed-regulation control unit
- 7 = Coolant temperature sensor
- 8 = Compressor-cutoff control unit
- 9 = Temperature switch 25°C EGR
- 10 = Engine-speed sensor, starting-motor ring gear
- 11 = Starting-motor ring gear

- 12 = Temperature switch 97°C EGR
- 13 = EGR control unit
- 14 = EGR change-over valve
- 15 = EGR microswitch
- 16 = Vacuum unit/pressure-control flap
- 17 = Change-over valve/pressure-control flap
- 18 = EGR line
- 19 = EGR valve

a = Passenger-compartment ventilation  
c = Other loads

SYSTEM OVERVIEW: PNEUMATIC / ELECTRONIC EXHAUST-GAS RECIRCULATION





S4000056

B1 = Engine-speed sensor  
 B2 = Coolant temperature sensor  
 F1 = Central electrics console  
 F2 = Over-voltage protection  
 P1 = Rev. counter  
 S1 = Glow-plug and starter switch  
 S2 = Temperature switch 25° C  
 S3 = Temperature switch 97° C  
 S4 = EGR microswitch

S5 = Microswitch, refrigerant-compressor  
 cutoff, EGR  
 X1 = EGR control unit  
 X2 = Idle-speed-regulation (ELR) control unit  
 X3 = Plug connection  
 X4 = Test coupling  
 Y1 = EGR change-over valve  
 Y2 = Change-over valve for pressure-control flap  
 Y3 = Servo magnet

ELECTRICAL TERMINAL DIAGRAM, EXHAUST-GAS RECIRCULATION WITHOUT A/C

Customer complaint (fault symptoms)

[illegible]

Customer complaint (fault symptoms)

*	*	*	*	*	*	Fuel-injection pump
---	---	---	---	---	---	---------------------

## EXHAUST-GAS RECIRCULATION

### Test conditions:

Exhaust-gas recirculation is effected if the following items are satisfied:

-Engine speed between  
950...1050 min<sup>-1</sup>  
and 2900...3000 min<sup>-1</sup>

-Coolant temperature between 25 °C  
and 97 °C

-Pressure-control flap closed between  
950...1050 min<sup>-1</sup>  
and 2450...2550 min<sup>-1</sup>

-Accelerator pedal not in full-throttle position, since  
EGR valve is closed shortly prior to full throttle by way  
of microswitch.

For production reasons:  
continued on the following  
coordinate.

## TEST EXHAUST-GAS RECIRCULATION ( 1 )

Test EGR valve with engine off:

Apply approx. 300 mbar vacuum to exhaust-gas recirculation valve.  
Detach vacuum line.

Can EGR valve be heard to close?

Renew EGR valve.

N>

Test pressure converter and pressure setting:

Installation location: bulkhead

Connect vacuum tester with Y-type distributor to EGR connection (exhaust-gas recirculation valve) and read off vacuum value at idle speed.

Set value: 330...370 mbar

Vacuum O.K.

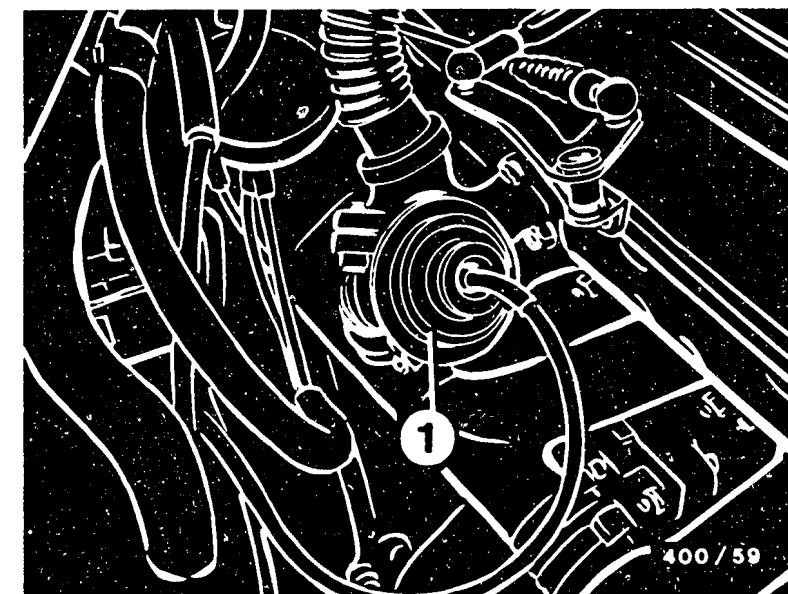
Test supply pressure at connection "C" (change-over valve).

Test vacuum supply at vacuum pump.

Set value: > 700 mbar.

N>

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1 = EGR valve



1 = Pressure converter

## TEST EXHAUST-GAS RECIRCULATION ( 2 )

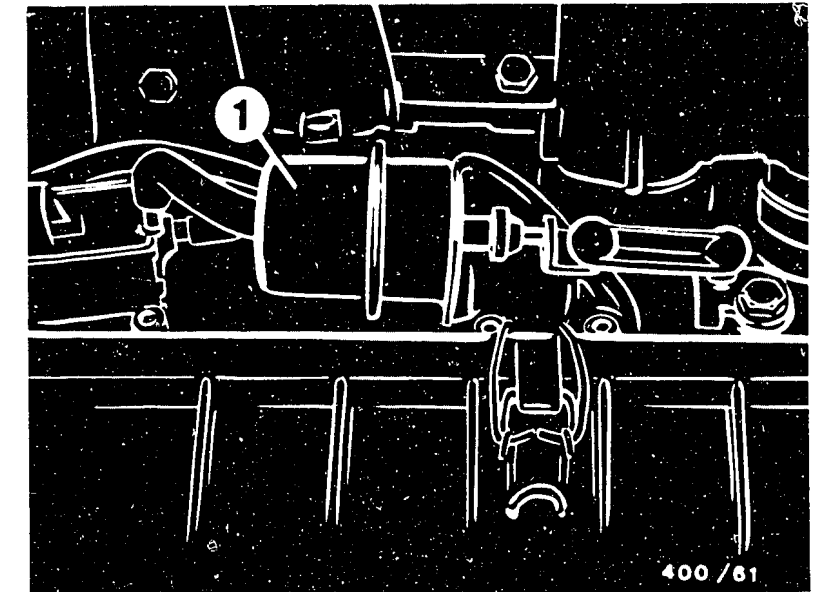
### Test vacuum control:

Connect vacuum tester with Y-type distributor to EGR valve.  
Read off vacuum values and position of vacuum unit/pressure-control flap at following engine speeds.

Set values: see test-specification section.  
Set values within tolerance.

N>

Test pressure supply and individual components.



1 = Vacuum unit

### Test microswitch.

Connect vacuum tester with Y-type distributor to EGR valve.  
Run engine at  $1000 \pm 50 \text{ min}^{-1}$ .  
Actuate microswitch 1.  
Pressure at EGR valve drops to 0 mbar.  
Pressure-control flap moves to basic setting (open).

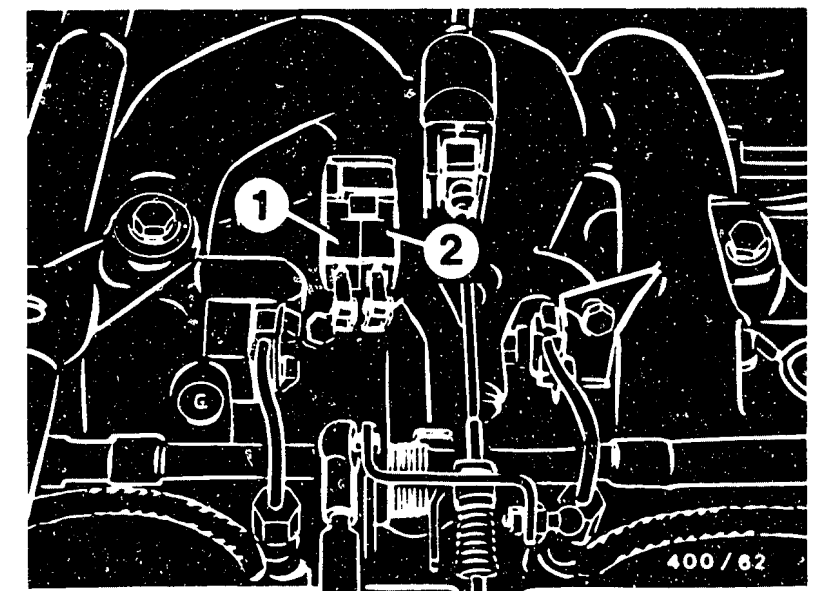
Actuate microswitch 2, pressure-control flap moves to basic setting.

Function O.K.

N>

Test individual components.

1 = Microswitch  
2 = Microswitch



Continued on next picture page

## TEST EXHAUST-GAS RECIRCULATION ( 3 )

V

### Test individual components

N>

Test vacuum control valve:

Connect vacuum tester to connection "VCV" of pressure converter and test vacuum at idle speed.

Set values:  
610...650 min  $-1$  / 360...410 mbar

Engine switched off and regulating linkage on full-load stop.

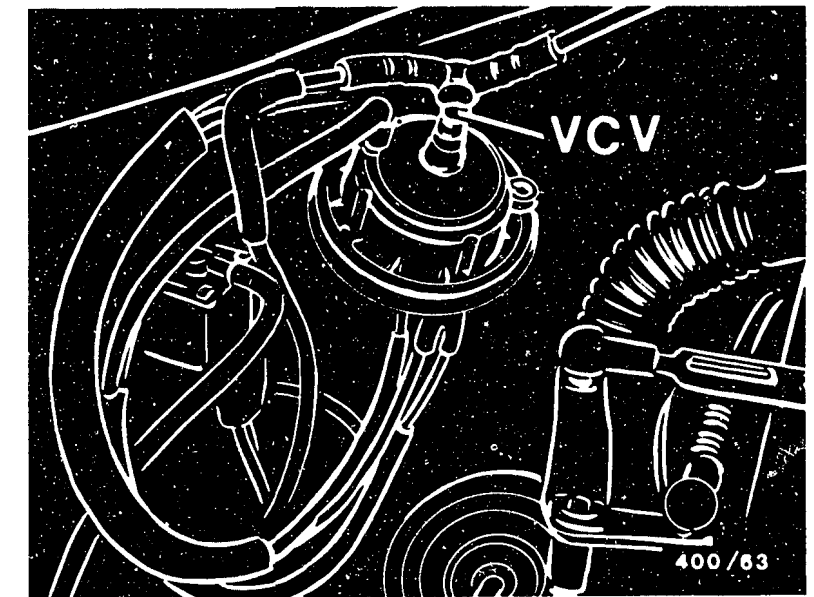
Set value: 0 mbar  
Are test specifications attained

Test vacuum lines for leaks:

Test supply pressure at vacuum pump.

Set value: > 700 mbar

Adjust vacuum control valve:  
Shift regulating lever of fuel-injection pump to full load.  
Turn vacuum control valve as far as it will go in a clockwise direction (slot), arrow.  
Tighten fastening screws in this position.



Y

V

### Test change-over valves:

N>

Connect voltmeter to plug connection of change-over valves.  
Run engine at 1150...1250 min  $-1$  .

Set value: 12 V

Set value attained

Test electrical actuation in accordance with diagram.  
Renew EGR control unit.

Y

V

Continued on next picture page

# TEST EXHAUST-GAS RECIRCULATION ( 4 )

Connect vacuum tester with Y-type distributor to connection "C", change-over valve.  
Run engine at 950..1050 min<sup>-1</sup>.  
Read off vacuum value.

Set value: 290...310 mbar  
(measured at both change-over valves).

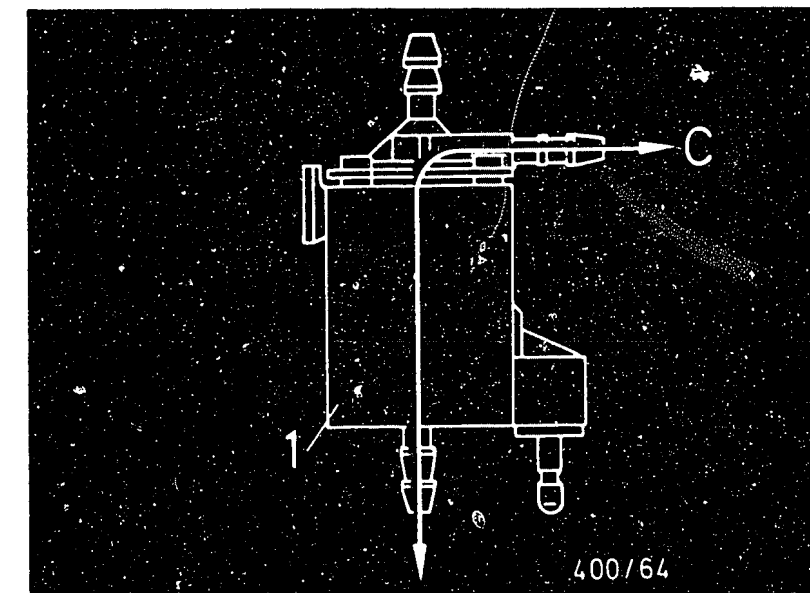
Vacuum value O.K.

N>

Test vacuum lines for leaks.

Test vacuum supply at vacuum pump.

Set value: > 700 mbar



1 = Change-over valve

Flashing code "2"

Component: Engine-speed sensor  
In engine compartment next to battery

Test 1: Ground connection

Detach multiple butt connector from engine-speed sensor.  
Connect ohmmeter with commercially available test prods to one wiring post in each case and ground.

Set value: > 1 M  $\Omega$

Set value attained?

N

Engine-speed sensor defective,  
renew.

Continued on next picture page

# TEST EXHAUST-GAS RECIRCULATION ( 5 )

## Test 2: Engine-speed signal

Connect multimeter to test coupling for engine-speed signal.  
Allow engine to idle.

Set value: > 2.8 V AC

N>

Detach multiple butt connector from engine-speed sensor.  
Connect ohmmeter with test leads to both wiring posts.

Set value: 1.7...2.1 K  $\Omega$

Set value outside tolerance  
Renew engine-speed sensor.

Y

Check to see whether engine-speed sensor is dirty:

Detach multiple butt connector from engine-speed sensor.  
Connect test lead.  
Allow engine to idle.

Test value: > 4 V

Note:  
Voltage increases with increasing engine speed.

N>

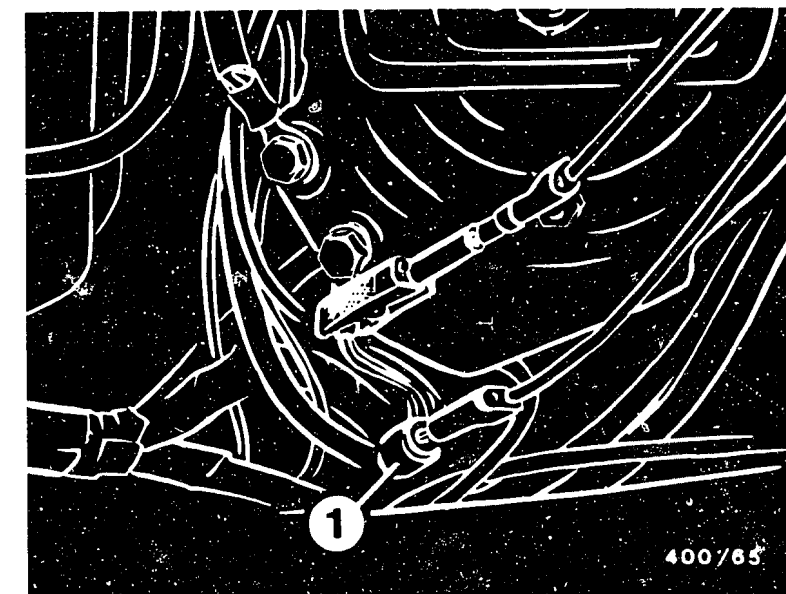
Check to see whether engine-speed sensor is dirty.

Test for open-circuit in leads.

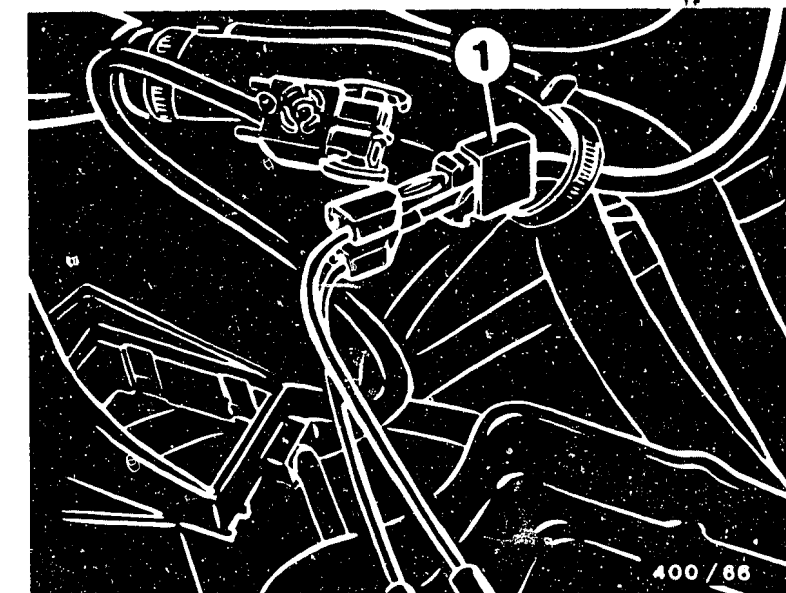
Renew EGR control unit.

Y

Continued on next picture page



1 = Test coupling  
Engine-speed signal



1 = Multiple butt connector  
Engine-speed sensor



# TEST EXHAUST-GAS RECIRCULATION ( 6 )

Test idle contact at microswitch.  
Top picture

Engine switched off.  
Detach coupling at microswitch.  
Connect ohmmeter with test lead to  
term. 2 and 4 and test for con-  
tinuity.

At idle: 0  $\Omega$   
With full throttle: infinity

Set value attained

Renew microswitch.

Test full-load contact at micro-  
switch:  
Bottom picture

Engine switched off.  
Coupling detached at microswitch.

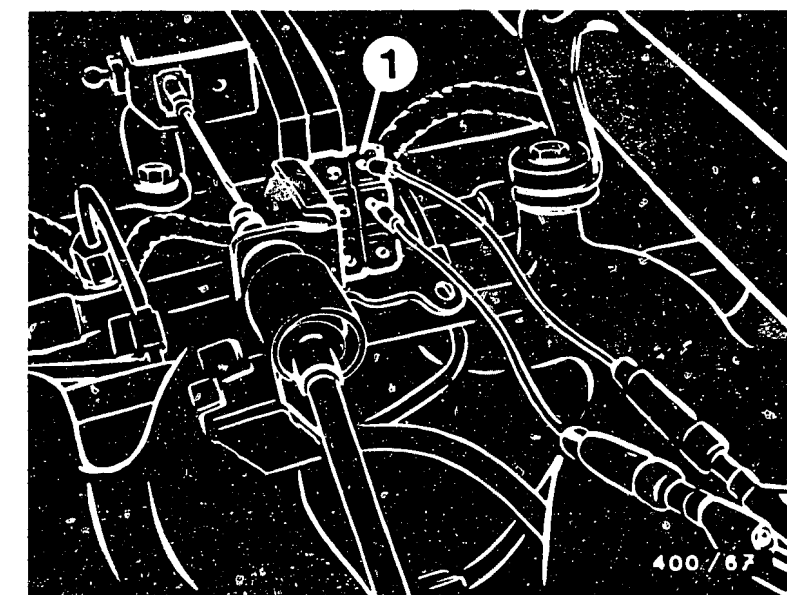
Connect ohmmeter with test lead to  
term. 1 and 3 and test for con-  
tinuity.

At idle: infinity  
With full throttle: 0  $\Omega$

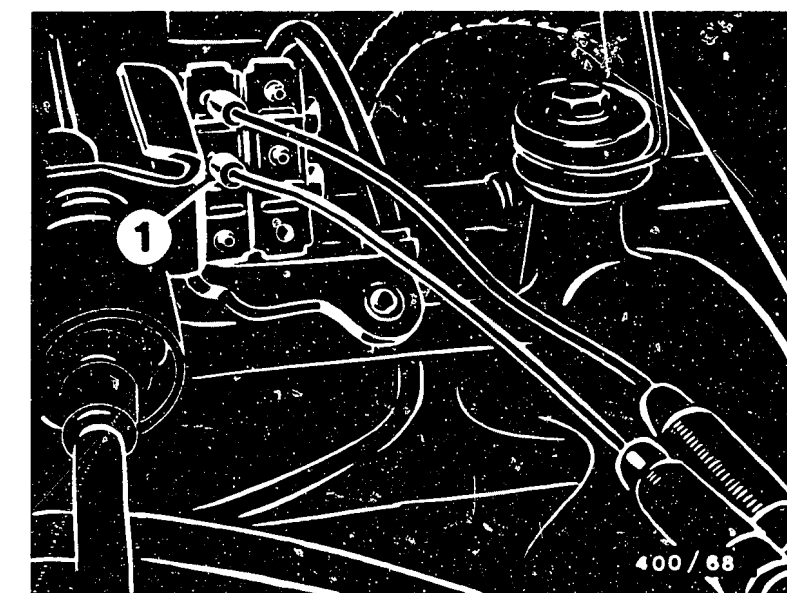
Reading O.K.

Renew microswitch.

Continued on next picture page



1 = Microswitch  
Idle contact



1 = Microswitch  
Full-load contact

## TEST EXHAUST-GAS RECIRCULATION ( 7 )

Test temperature switch 25°C:

Connect vacuum tester to EGR valve.

Engine temperature > 25°C  
Run engine at 1000 min<sup>-1</sup> ,

Detach connector from temperature  
switch and ground it.

Set value: 0 mbar

Function O.K.

N>

Test electrical actuation.

Test temperature switch 97°C:

Connect vacuum tester to EGR valve.

Run engine at 1200 min<sup>-1</sup> ,  
Detach connector from temperature  
switch and ground it.

Set value: 0 mbar

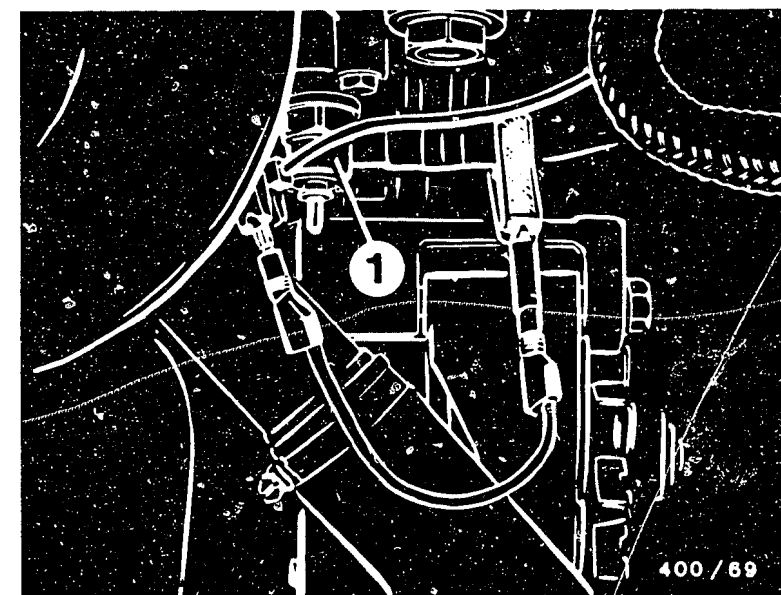
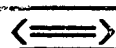
Function O.K.

N>

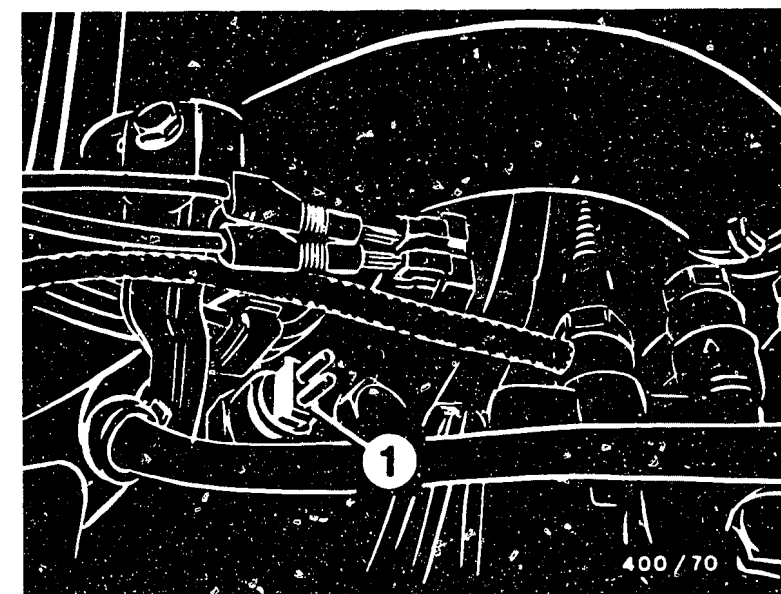
Test electrical actuation.

Return to trouble-shooting chart  
09

H25



1 = Temperature switch 25° C

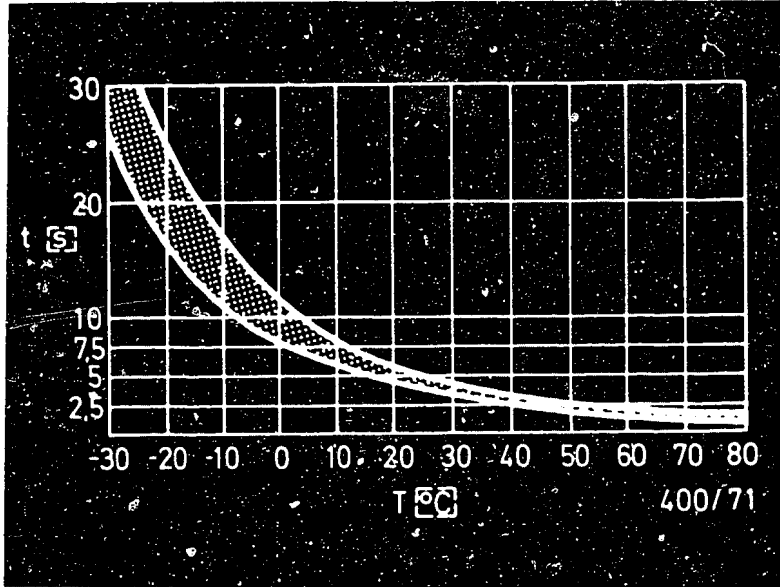
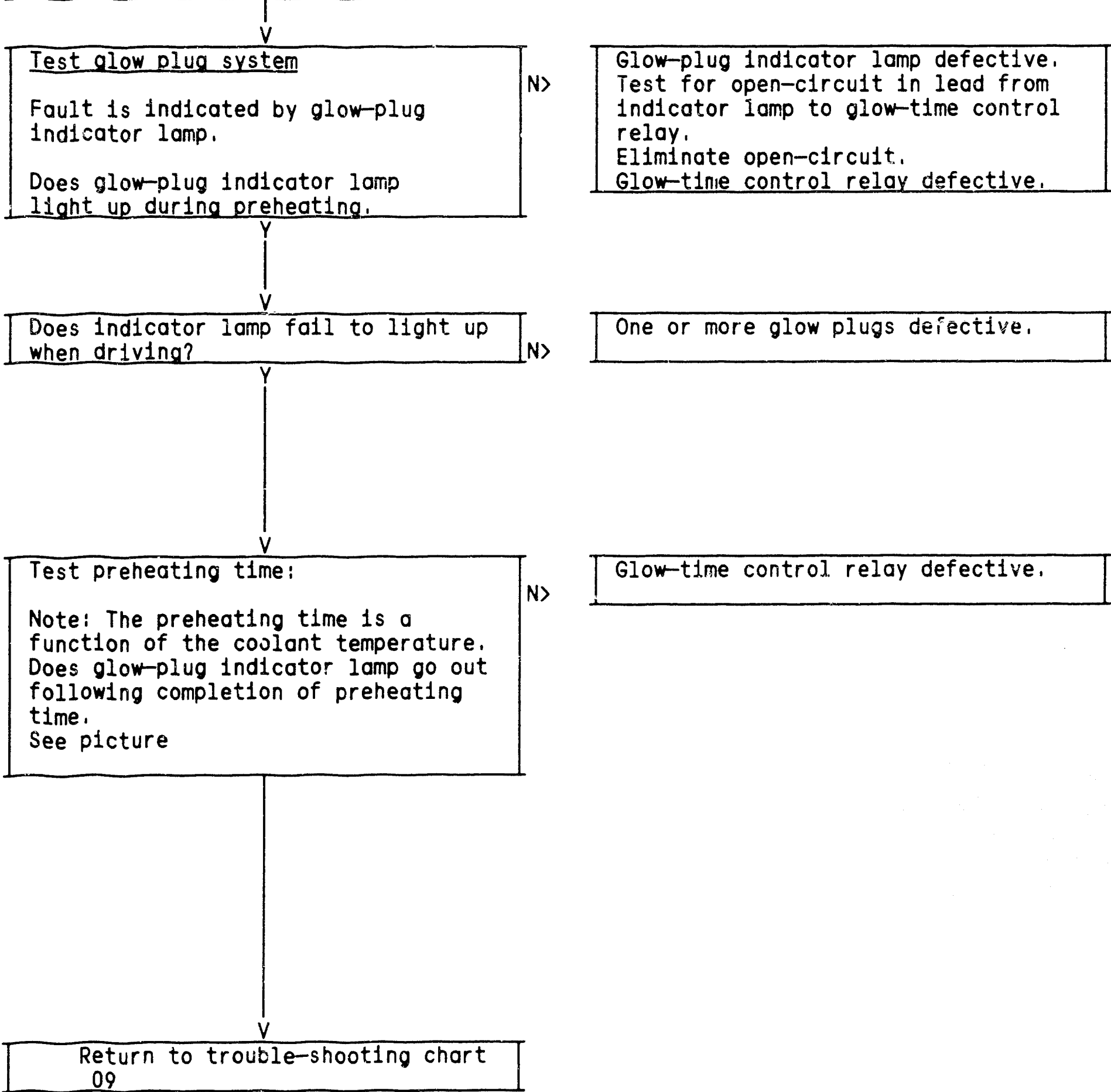


1 = Temperature switch 97° C

H26



TESTIN PREHEATING SYSTEM 1



Trouble-shooting instructions : MB-5048

BOSCH system : M-pump with RSF governor

Make of vehicle : MB

Basic microcard : FZD-00..

T A B L E O F C O N T E N T S

Section	Coordinate
Special features, usage.....	02
Test specifications.....	03
Testers and tools.....	04
Electrical terminal diagram.....	05
Trouble-shooting chart.....	09
Self-diagnosis by way of flashing-code evaluation..	11
Self-diagnosis test program.....	12
Component:	
Engine-speed sensor.....	15
Water temperature sensor.....	17
Servo magnet, active bucking damping (ARD).....	19
Servo magnet, idle-speed regulation (ELR).....	21
Individual trimming plug.....	25

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes-Benz models

- 190 D 2.5 (type 201)
- 250 D (type 124)
- 300 D (type 124)

with active bucking damping (ARD) 9.87 ->

Engine: OM 602.. / 603 ..  
EU/S - Standard  
with mechanical transmission

Vehicles of the country version - Switzerland - are additionally equipped with an exhaust-gas recirculation system.

USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart gives an indication of various causes/component faults.

Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

## TEST SPECIFICATIONS

Idle speed:

Engine	Pneumatic idle increase	Regulated	Unregulated..
602	650...750		
603.912		610...650	530...610
603.913		660...700	530...610
4Matic			

Individual trimming plugs:

Part No.	Resistance	Complaint
000 540 2981	100 $\Omega$	Part-load bucking
000 540 2281	220 $\Omega$	
000 540 2381	470 $\Omega$	
000 540 2581	1300 $\Omega$	Poor acceleration
000 540 2681	2400 $\Omega$	
000 540 2781	4700 $\Omega$	

## TESTERS AND TOOLS

Name

### Designation

Part no.

Evaluation unit  
for flashing-code  
diagnosis

KDAW 9980

## Ohmmeter

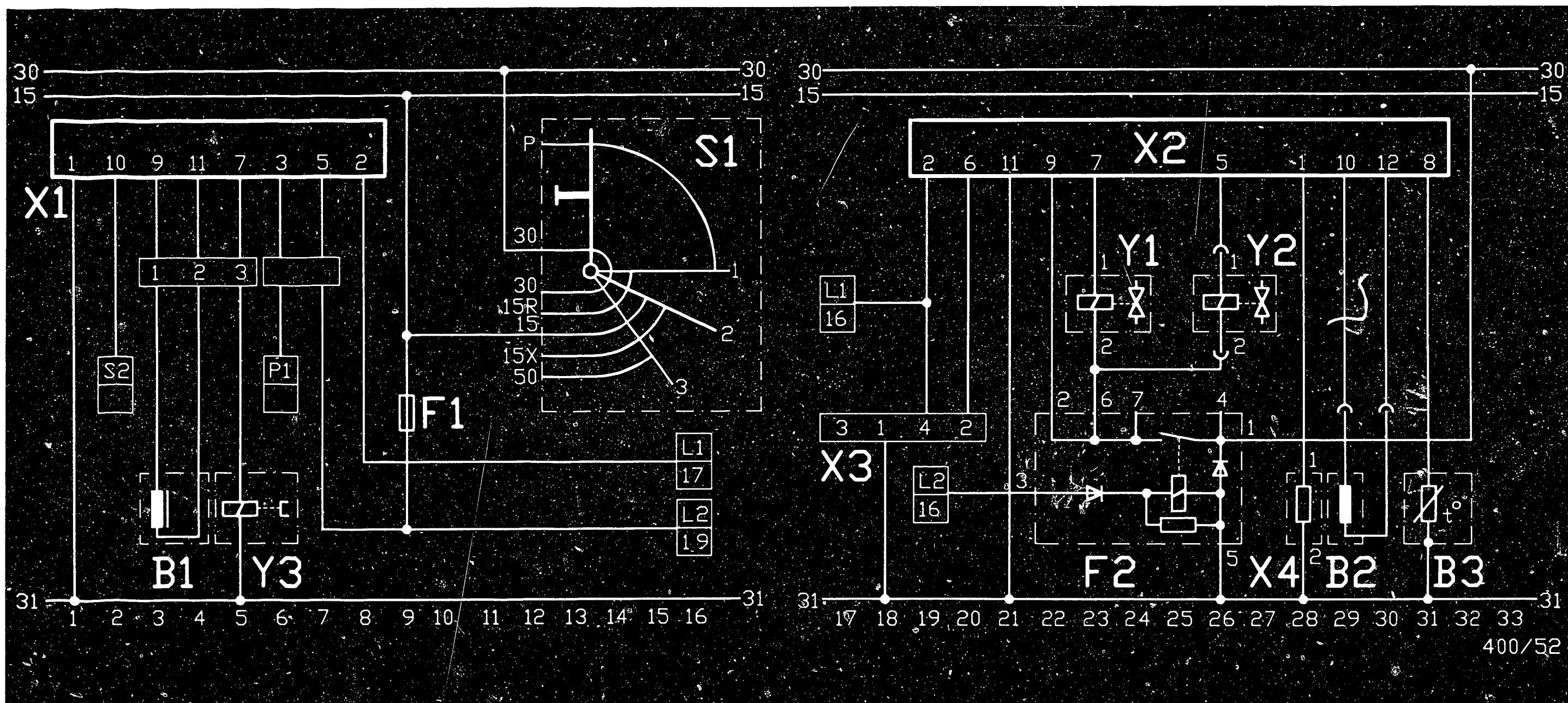
ETE 014.00

0 684 101 400

## Voltmeter

ETE 014.00

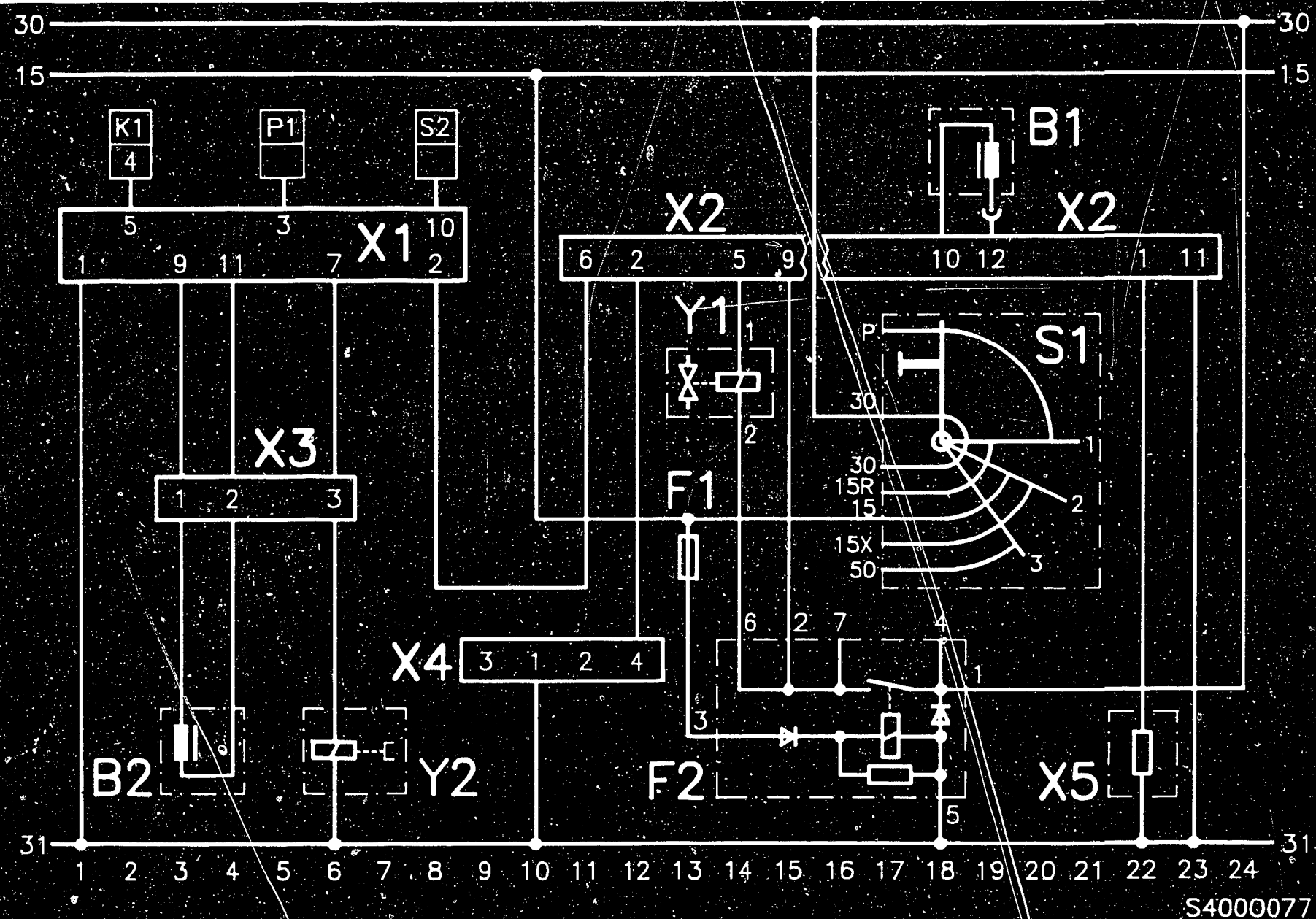
0 684 101 400



400/52

- |  |  |
|--|--|
| B1/Y3 = Refrigerant compressor                   | X1 = Control unit, refrigerant-compressor cutoff |
| B2 = Eng.-speed sensor, starting-motor ring gear | X2 = Control unit, idle-speed regulation (ARD)   |
| B3 = Coolant temperature sensor                  | Active bucking damping                           |
| F1 = Central electrics console                   | X3 = Test coupling for flashing-code diagnosis   |
| F2 = Over-voltage protection                     | X4 = Individual trimming plug (as required)      |
| P1 = Rev. counter                                | Y1 = Servo magnet, electronic                    |
| S1 = Glow-plug and starter switch                | idle-speed regulation (ELR)                      |
| S2 = Pressure switch, refrigerant compressor     | Y2 = Servo magnet, active bucking damping (ARD)  |

ELECTRICAL TERMINAL DIAGRAM TYPE 124 ENGINE 603 WITH ELR/ARD AND AUTOMATIC AIR CONDITIONING



S4000077

- |       |   |    |   |
|-------|---|----|---|
| B1    | = Engine-speed sensor, starting-motor ring gear | S2 | = Pressure switch, refrigerant compressor |
| B2/Y2 | = Refrigerant compressor                        | X1 | = Control unit, refrigerant-comp. cutoff  |
| F1    | = Central electrics console                     | X2 | = Control unit, act.bucking damping (ARD) |
| F2    | = Relay, over-voltage protection                | X4 | = Test coupling for flashing-code diag.   |
| K1    | = Relay, auxiliary fan                          | X5 | = Individual trimming plug (as required)  |
| P1    | = Rev. counter                                  | Y1 | = Servo magnet, act.bucking damping (ARD) |
| S1    | = Glow-plug and starter switch                  |    |   |

ELECTRICAL TERMINAL DIAGRAM TYPE 201 ENGINE 602 WITH ARD AND AUTOMATIC AIR CONDITIONING

## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Diagnosis lamp flashes (activation with KDAW 9980)
  2. Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
  3. Engine hunts when idling
  4. Idle not smooth with warm engine
  5. Idle speed too high/too low
  6. Engine missing when driving
  7. Inadequate engine power
  8. Engine bucks at full load
  9. Fuel consumption too high
  10. Engine doesn't switch off or not immediately
  11. Hard engine running
- Cause (component fault)

**Cause (component fault)**

[illegible]

## TROUBLE-SHOOTING CHART

**Customer complaint (fault symptoms)**

- 12. Black smoke in full-load range
- 13. Cloud of smoke in full-load range
- 14. Engine won't rev up when cold
- 15. Part-load bucking
- 16. Poor acceleration
- 17. Fuel-injection pump

Cause (component fault)	Effect
1. Faulty fuel pump	1. Engine stalls
2. Faulty spark plug	2. Engine misfires
3. Faulty valve timing	3. Engine runs poorly
4. Faulty oil pressure	4. Engine overheats
5. Faulty water pump	5. Engine overheats
6. Faulty thermostat	6. Engine overheats
7. Faulty radiator fan	7. Engine overheats
8. Faulty coolant level	8. Engine overheats
9. Faulty timing belt	9. Engine stalls
10. Faulty oil level	10. Engine overheats
11. Faulty oil filter	11. Engine overheats
12. Faulty oil pump	12. Engine overheats
13. Faulty oil pressure switch	13. Engine overheats
14. Faulty oil pressure sensor	14. Engine overheats
15. Faulty oil pressure gauge	15. Engine overheats
16. Faulty oil pressure warning light	16. Engine overheats
17. Faulty oil pressure switch solenoid	17. Engine overheats
18. Faulty oil pressure switch valve	18. Engine overheats
19. Faulty oil pressure switch gasket	19. Engine overheats
20. Faulty oil pressure switch seal	20. Engine overheats
21. Faulty oil pressure switch O-ring	21. Engine overheats
22. Faulty oil pressure switch plug	22. Engine overheats
23. Faulty oil pressure switch nut	23. Engine overheats
24. Faulty oil pressure switch washer	24. Engine overheats
25. Faulty oil pressure switch lockwasher	25. Engine overheats
26. Faulty oil pressure switch locknut	26. Engine overheats
27. Faulty oil pressure switch lockwasher	27. Engine overheats
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50. Faulty oil pressure switch locknut	50. Engine overheats
51. Faulty oil pressure switch lockwasher	51. Engine overheats
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71. Faulty oil pressure switch lockwasher	71. Engine overheats
72. Faulty oil pressure switch locknut	72. Engine overheats
73. Faulty oil pressure switch lockwasher	73. Engine overheats
74. Faulty oil pressure switch locknut	74. Engine overheats
75. Faulty oil pressure switch lockwasher	75. Engine overheats
76. Faulty oil pressure switch locknut	76. Engine overheats
77. Faulty oil pressure switch lockwasher	77. Engine overheats
78. Faulty oil pressure switch locknut	78. Engine overheats
79. Faulty oil pressure switch lockwasher	79. Engine overheats
80. Faulty oil pressure switch locknut	80. Engine overheats
81. Faulty oil pressure switch lockwasher	81. Engine overheats
82. Faulty oil pressure switch locknut	82. Engine overheats
83. Faulty oil pressure switch lockwasher	83. Engine overheats
84. Faulty oil pressure switch locknut	84. Engine overheats
85. Faulty oil pressure switch lockwasher	85. Engine overheats
86. Faulty oil pressure switch locknut	86. Engine overheats
87. Faulty oil pressure switch lockwasher	87. Engine overheats
88. Faulty oil pressure switch locknut	88. Engine overheats
89. Faulty oil pressure switch lockwasher	89. Engine overheats
90. Faulty oil pressure switch locknut	90. Engine overheats
91. Faulty oil pressure switch lockwasher	91. Engine overheats
92. Faulty oil pressure switch locknut	92. Engine overheats
93. Faulty oil pressure switch lockwasher	93. Engine overheats
94. Faulty oil pressure switch locknut	94. Engine overheats
95. Faulty oil pressure switch lockwasher	95. Engine overheats
96. Faulty oil pressure switch locknut	96. Engine overheats
97. Faulty oil pressure switch lockwasher	97. Engine overheats
98. Faulty oil pressure switch locknut	98. Engine overheats
99. Faulty oil pressure switch lockwasher	99. Engine overheats
100. Faulty oil pressure switch locknut	100. Engine overheats

Self-diagnosis
----------------

## Tank ventilation

Injection sequence
--------------------

## Paraffin separation

## Air in fuel system

Fuel lines leaking/clogged
----------------------------

Supply lines clogged
----------------------

Fuel-injection tubing clogged/constricted
--

Engine air filter
-------------------

Idle speed, mechanical	1000
------------------------	------

Test idle-speed regulation (ELR)	
-------------------------------------	--

Test active bucking damping (ARD)
-----------------------------------

## Mechanical features of speed regulation

## Vacuum system

*	*			*	Injection nozzles
---	---	--	--	---	-------------------

Fuel filter/overflow restriction

Supply pump

## Glow plug system

Timing device

*	*					Engine compression
---	---	--	--	--	--	--------------------

*	*					Pump/engine assignment
---	---	--	--	--	--	------------------------

*	*	*	*	*	*	Fuel-injection pump
---	---	---	---	---	---	---------------------



## FLASHING-CODE EVALUATION

Connect socket 3 of evaluation unit for flashing-code diagnosis KDAW 9980 to a fused positive lead.

Connect socket 4 to socket 1 of evaluation unit.

Connect socket 2 to socket 4 of diagnosis socket.

Start engine.

Actuate nonlocking switch (evaluation unit) for between 2 and 4 seconds.

Then keep nonlocking switch pressed.

Flashing code of corresponding faulty component is indicated.

Repeat flashing-code evaluation:

Briefly disconnect plug connection (socket 4, diagnosis socket).

Press nonlocking switch.

Scan flashing code.

## SELF-DIAGNOSIS TEST PROGRAM

Breakdown of self-diagnosis (flashing code)

- 1 x All functions O.K.
- 2 x Engine-speed sensor
- 3 x Coolant temperature sensor
- 5 x Closed loop, active bucking damping (ARD)\*
- 6 x Closed loop, idle increase (ELR)\*

\* Only short-circuit faults are detected

Test conditions:

- Coolant temperature 60...80°C
- Fuse of over-voltage protection O.K.
- Mechanical transmission:  
Battery voltage at least 11.5 V between socket 1 and socket 5 of over-voltage protection.
- Automatic transmission:  
Battery voltage at least 11.5 V. Selector lever in position "P".
- A/C off
- All plug connections made.
- Idle speed

Engine	Pneumatic idle increase	Regulated	Unreg.
602	650...750		
603.912		610...650	530...610
603.913		660...700	530...610
4Matic			

# SELF-DIAGNOSIS TEST PROGRAM ( 1 )

Flashing Code "2"

Component: Engine-speed sensor

In engine compartment next to battery

Test 1: Ground connection

Detach multiple butt connector from engine-speed sensor.

Connect ohmmeter with commercially available test prods to one wiring post in each case and ground.

Set value:  $> 1 \text{ M } \Omega$

Set value attained?

Engine-speed sensor defective,  
renew.

Test 2: Internal resistance

Detach multiple butt connector from engine-speed sensor.

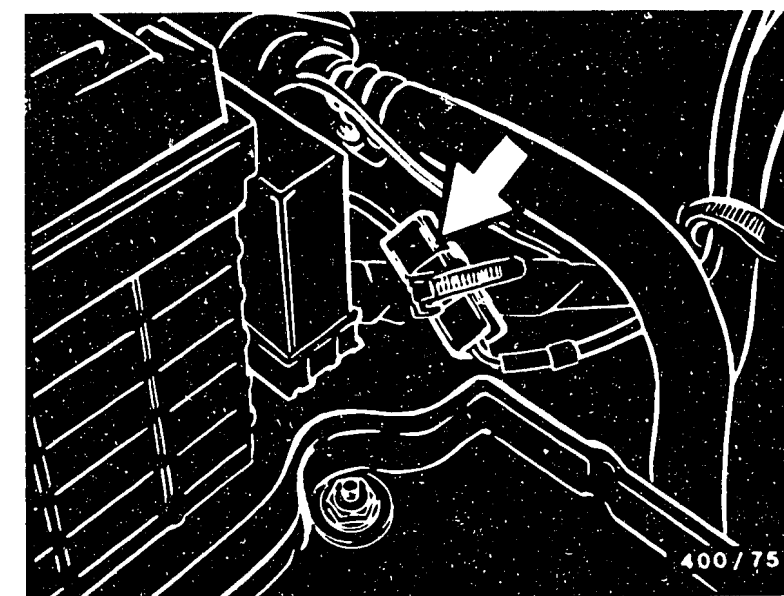
Connect ohmmeter to pins of multiple butt connector.

Set value:  $1.7 \dots 2.1 \text{ K } \Omega$

Set value outside tolerance

Engine-speed sensor defective,  
renew.

Continued on next picture page



## Test 3:

Check to see whether engine-speed sensor is dirty.

Detach multiple butt connector from engine-speed sensor.  
Connect test lead to both wiring posts.

Allow engine to idle.

Set value : > 4 V AC

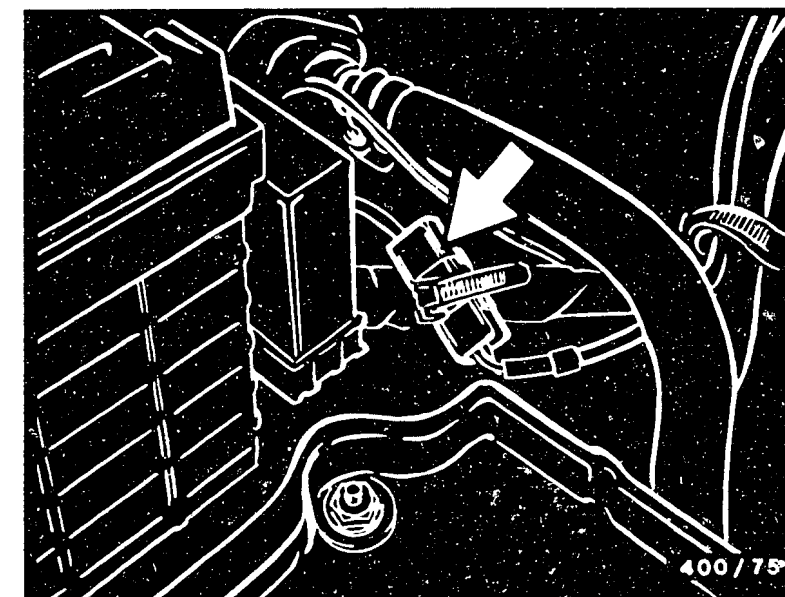
## Note:

Voltage increases with increasing engine speed.

Is set value attained?

N&gt;

Check to see whether dirt has accumulated on engine-speed sensor and clean if necessary.  
Eliminate open-circuit in lead.  
Renew control unit.



Continued on next picture page

# SELF-DIAGNOSIS TEST PROGRAM ( 2 )

Flashing code "3"

Component: Water temperature sensor

N>

Water temperature sensor defective,  
renew.

Test 1: Resistance

Engine switched off. Detach  
connector at temperature sensor.  
Test ohmmeter with test lead with  
respect to ground (top picture).

See diagram for set values.

Set value at:

+ 20 °C = 2200...2800 Ω

+ 80 °C = 290...370 Ω

Test 2: Voltage supply.

N>

Test for open-circuit in connector  
of water temperature sensor.

Detach connector at water  
temperature sensor.  
Connect voltmeter with commercially  
available test lead to 1-pole plug.  
Switch on ignition.

Set value approx. 5 V

Is set value attained?

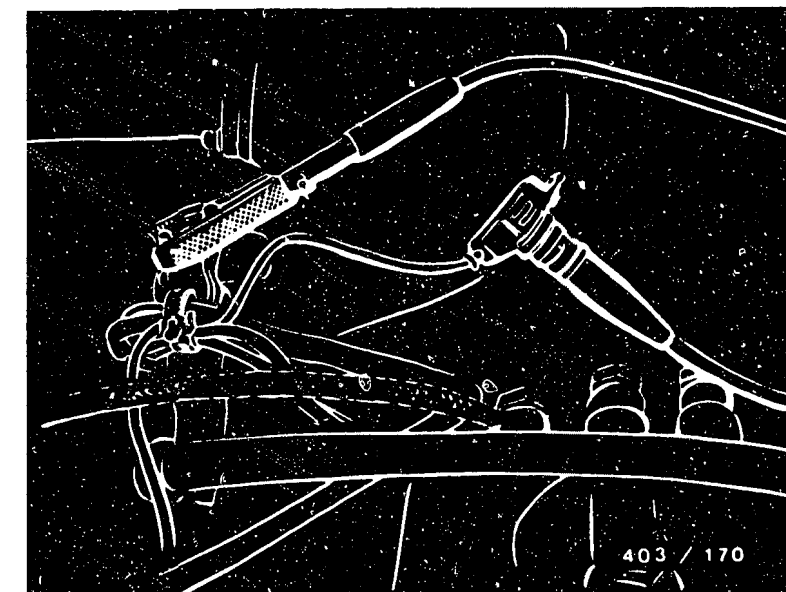
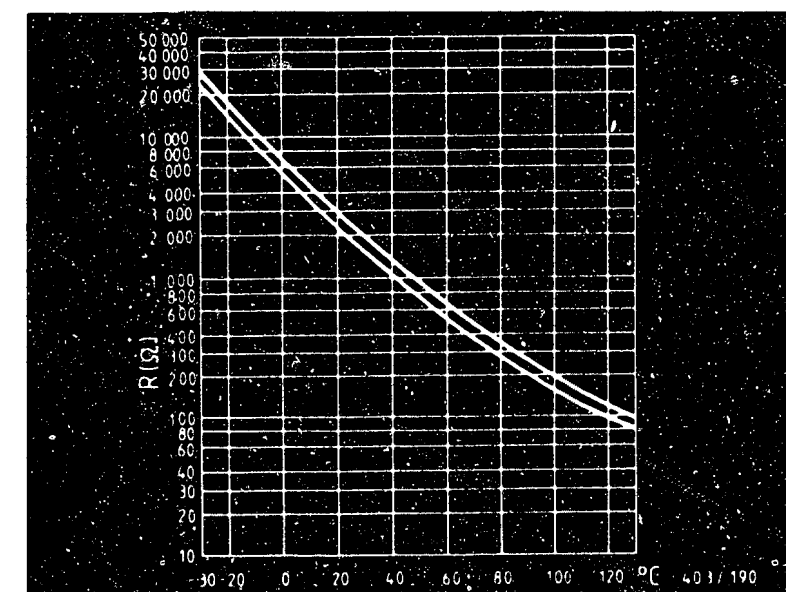
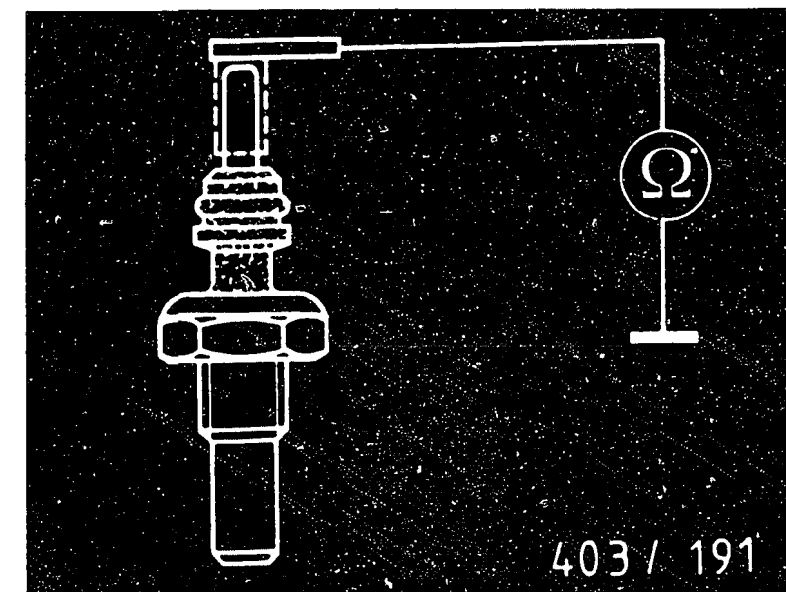
Continued on next picture page

J17

<=>

J18

<=>



# SELF-DIAGNOSIS TEST PROGRAM ( 3 )

Flashing code: "5"

Component: Test active bucking damping (ARD) for proper functioning.

Allow engine to idle.

Slowly increase engine speed to approx. 900 min<sup>-1</sup>. The engine must briefly misfire.

(ARD) functioning?

N>

1st test  
Test ARD servo magnet.

Detach plug connection at servo magnet of fuel-injection pump.

Apply battery voltage (only for brief period, approx. 3 sec., otherwise servo magnet defect). See top picture.

If idle speed does not decrease , renew ARD servo magnet.

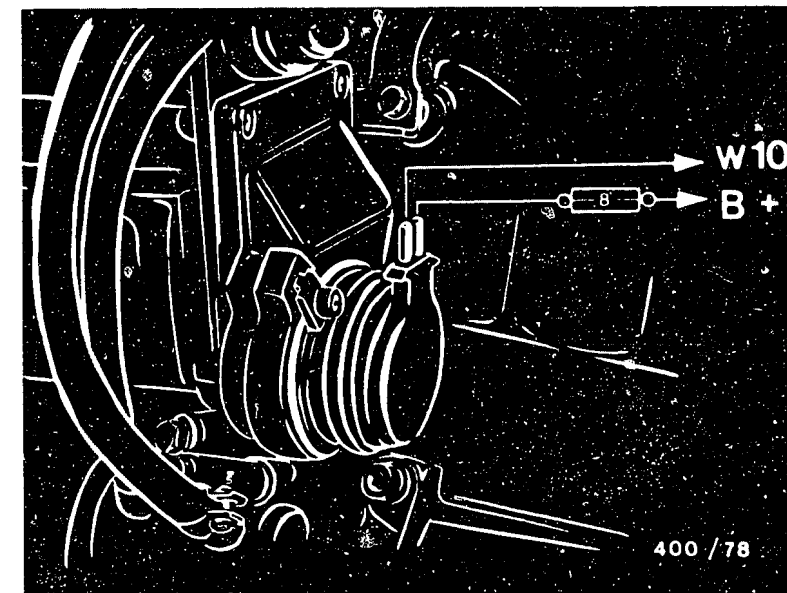
When renewing servo magnet, existing shift pin (arrow) must be installed in new servo magnet.

This ensures that the clearance between spring retainer and lifter rod is maintained.

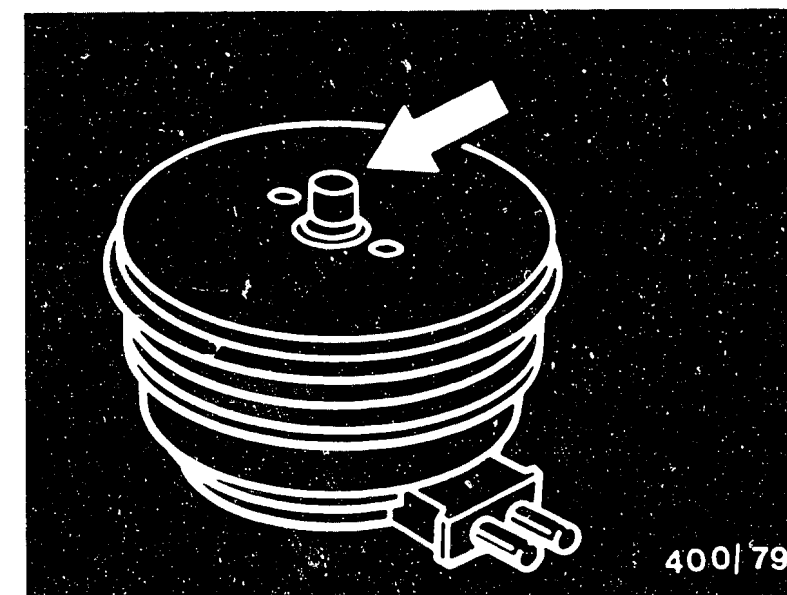
If idle speed decreases, test voltage at ARD plug. Allow engine to idle. Briefly acc. to full throttle. If there is no increase in voltage value, check fuse at over-voltage protection. Test leads in accordance with circuit diagram.

End of test.  
Active bucking damping O.K.

Continued on next picture page



400 / 78



400 / 79

# SELF-DIAGNOSIS TEST PROGRAM ( 4 )

Flashing code: "6"

Component: Test idle-speed regulation (ELR)  
Engine 603 only.

Engine idling.  
Regulated idle speed  
Set value:

Engine 603 912:  
610...650 min<sup>-1</sup>  
Engine 603 913:  
660...700 min<sup>-1</sup>

Detach plug at servo magnet  
for at least 3 seconds.

Upon re-connection, idle  
speed briefly exceeds the  
regulated idle speed.  
Does the idle speed increase ?

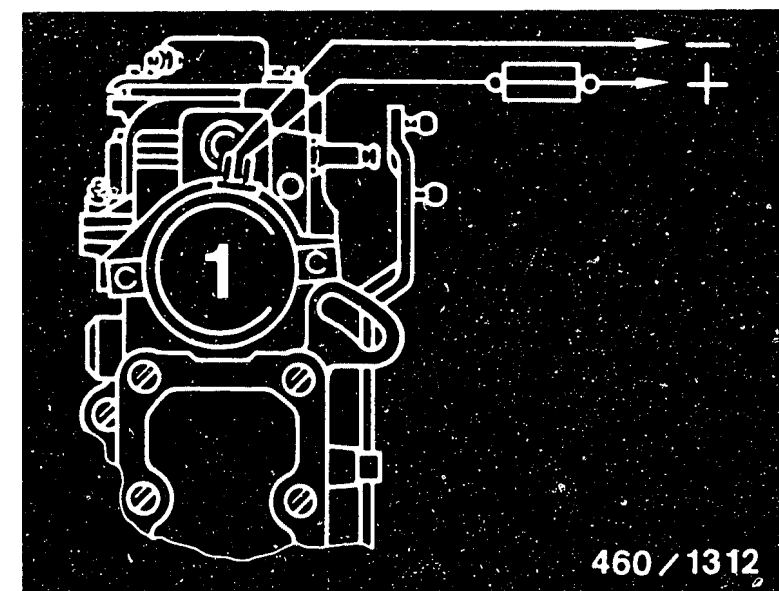
N>

## 1st test step

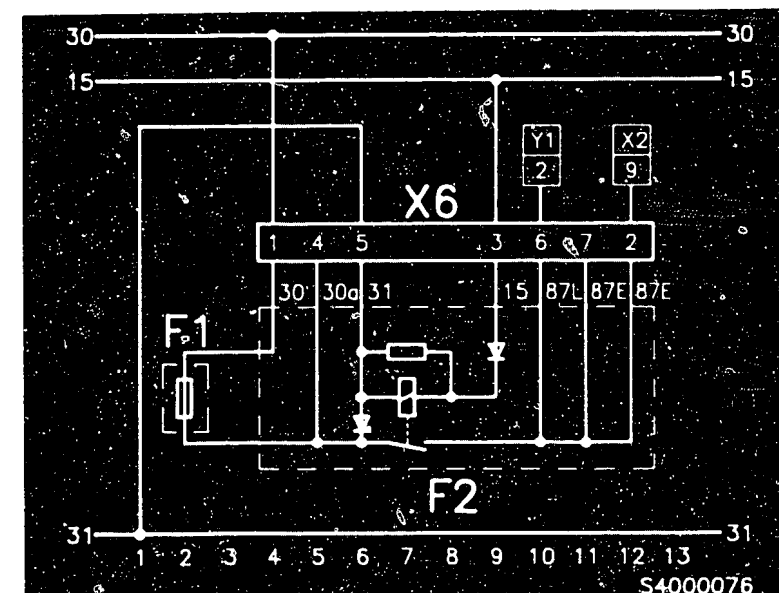
1. Detach plug at servo magnet;  
apply (see picture) 12 V for brief  
period (max. 3 seconds as otherwise  
servo magnet defective).  
If there is no increase in idle  
speed:  
Servo magnet defective - renew  
Pay attention to shims when removing  
and installing.

## 2nd test step

1. Engine switched off.  
Use voltmeter to establish whether  
approx. battery voltage is being  
applied at both contacts of fuse  
at over-voltage protection.  
Renew defective fuse.  
2. Test for open-circuit in lead  
of engine multiple butt connector  
term. 30, plug-connection lead,  
engine compartment socket 1 and  
battery ground lead with respect  
to over-voltage protection term. 1,  
5 and 3 in each case.  
3. Test for open-circuit in lead  
from over-voltage protection  
term. 6 to servo magnet.  
Eliminate open-circuit.



X6 = Plug connection  
F1 = Central electrics console  
F2 = Over-voltage protection



Continued on next picture page

Continued on next picture page

J21

<==>

J22

<==>

4. Detach ELR/ARD control unit.  
Test for open-circuit in  
leads from control-unit  
base term. 11 to battery ground,  
from term. 8 to coolant  
temperature sensor, from term. 10  
and 12 to engine-speed sensor  
and term. 9 to over-voltage  
protection term. 12.  
Eliminate open-circuit.

3rd TEST STEP  
Attach control unit.  
Engine idling.  
Detach plug from servo magnet  
and test voltage at plug.  
Set value for reading:  
approx. 12 volts  
If voltage not attained,  
renew ALR/ARD control unit

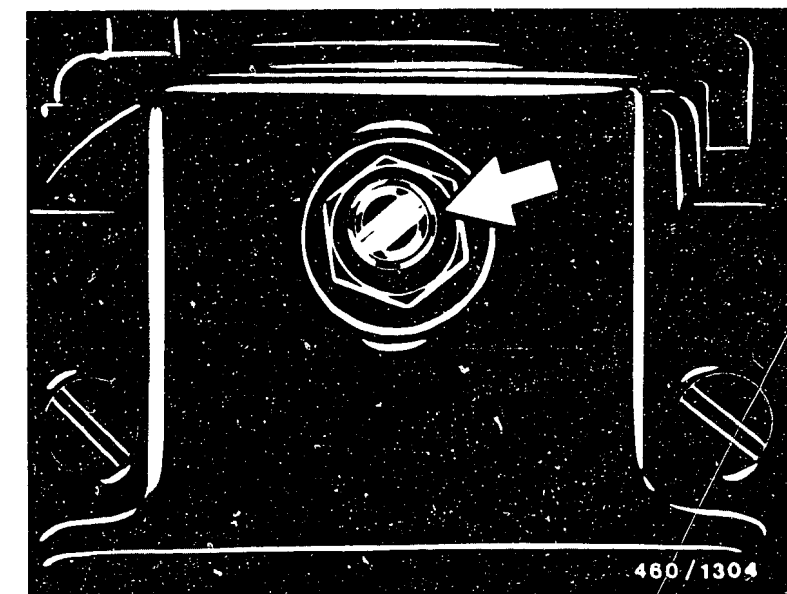
Loosen lock nut and adjust idle  
speed at idle-speed adjusting screw  
(arrow)

Test unregulated idle speed.  
Plug at servo magnet  
detached.

Engine 603.912:  
530...610 min<sup>-1</sup>  
Engine 603.913:  
530...610 min<sup>-1</sup>

Idle speed O.K.

Continued on next picture page



V

Test individual trimming plug  
-if applicable  
Installation pos.: Next to batt.

N&gt;

Test for open-circuit in lead  
from individual trimming plug to  
ELR/ARD control unit term. 1  
and eliminate any open-circuits.

Engine switched off.  
Detach individual trimming  
plug from twin coupling.  
Glow-plug and starter switch  
in pos. "2", measure voltage.

Set value: approx. 5 volts

Y  
V

Renew individual trimming plug.  
3 different resistors can be  
fitted depending on the  
complaint. Test drive vehicle  
following modification.

Part-load bucking

Part No.	Resistance
000 540 2981	100 $\Omega$
000 540 2281	220 $\Omega$
000 540 2381	470 $\Omega$

Poor acceleration:

Part No.	Resistance
000 540 2581	1300 $\Omega$
000 540 2681	2400 $\Omega$
000 540 2781	4700 $\Omega$

Note:

The ignition must be switched  
off when changing the indivi-  
dual trimming plug.  
Otherwise the new trimming  
is not detected.



Trouble-shooting instructions : OPE-5007  
BOSCH system : VE..F..  
Make of vehicle : OPEL  
Basic microcard : FZD-00..

TABLE OF CONTENTS

Section	Coordinates
Special features.....	02
Structure, usage.....	02
Trouble-shooting chart.....	03
Test specifications.....	07
Tightening torques.....	08
Electrical terminal diagram.....	09
Installation position of components.....	11

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following OPEL model:

OPEL Corsa Diesel  
1.5 l / 4-cylinder engine / 37 kW  
with distributor-type fuel-injection pump VE..F..

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)									
1.									Starting motor operates, but engine fails to start or starts only with difficulty (when warm or cold)
2.									Engine hunts when idling
3.									Rough idling when engine is warm
4.									Fuel consumption high, maximum engine power not reached, and smoke formation
5.									Unsatisfactory performance
6.									Black smoke in full-load range, engine running rough; possibly lack of power
7.									Engine running rough
Cause (component fault)									
*	*				*				Tank empty, tank breather
*		*							Injection sequence not firing order
	*				*				Inlet-union screws, inlet/return
*									Shutoff device
		*			*				Air in fuel system
	*								Paraffin separation
									Fuel lines leaking
*					*				Fuel lines clogged
*					*				Supply lines clogged
					*				Engine air filter
		*							Idle speed
*		*			*		*		Injection nozzle
*									Preheating system

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)									
1.									Starting motor operates, but engine fails to start or starts only with difficulty (when warm or cold)
2.									Engine hunts when idling
3.									Rough idling when engine is warm
4.									Fuel consumption high, maximum engine power not reached, and smoke formation
5.									Unsatisfactory performance
6.									Black smoke in full-load range, engine running rough; possible lack of power
7.									Engine running rough
Cause (component fault)									
*					*				Fuel filter
					*	*	*		Timing device
*		*							Engine compression
					*	*	*	*	Coordination, pump - engine (injection timing)
					*	*	*		Engine timing

## TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

8. Engine misfiring during vehicle operation

9. Engine cannot be switched off

10. Incorrect engine speeds

11. Engine will not rev up when cold

12. High idle and engine running rough at high engine speed

13. Black smoke in full-load range

14. Fog-like smoke in full-load range (white)

Cause (component fault)

\* Tank empty, tank breather

\* Injection sequence not firing order

\* Inlet-union screws, inlet/return

\* \* Shutoff device

\* Air in the fuel system

\* Paraffin separation

\* Fuel lines leaking

\* Fuel lines clogged

\* Supply lines clogged

\* Engine air filter

\* Idle speed

## TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

8. Engine misfiring during vehicle operation

9. Engine cannot be switched off

10. Incorrect engine speeds

11. Engine will not rev up when cold

12. High idle and engine running rough at high engine speed

13. Black smoke in full-load range

14. Fog-like smoke in full-load range (white)

Cause (component fault)

\* Fuel filter

\* Timing device

\* Engine compression

\* \* Coordination, pump - engine (injection timing)

\* Engine timing

## TEST SPECIFICATIONS

## Idle speed:

\* Engine warm: 780...840 min<sup>-1</sup>

\* Engine cold: 950...1000 min<sup>-1</sup>

Nozzle-opening pressure: 152...162 bar

Coordination, pump - engine  
(injection timing):

## Setting:

\* Engine position at TDC: 1. cylinder

\* Pump position after BDC: 0,90 mm

## Check value:

\* Engine position at TDC: 1. cylinder

\* Pump position after BDC: 0,85...0,95 mm

Compression: 22 bar

Max. difference between  
cylinders: 1 bar

## Filter test

\* Max. permissible  
differential pressure: 0,3 bar

## TIGHTENING TORQUES

Fuel lines 25 Nm

Fastening screws /  
injection pump 25 Nm

Fastening screws /  
nozzle-holder assembly 50 Nm

Sheathed-element glow plugs 25 Nm

Screw plug 15 Nm

Nut / injection-pump  
gear 70 Nm

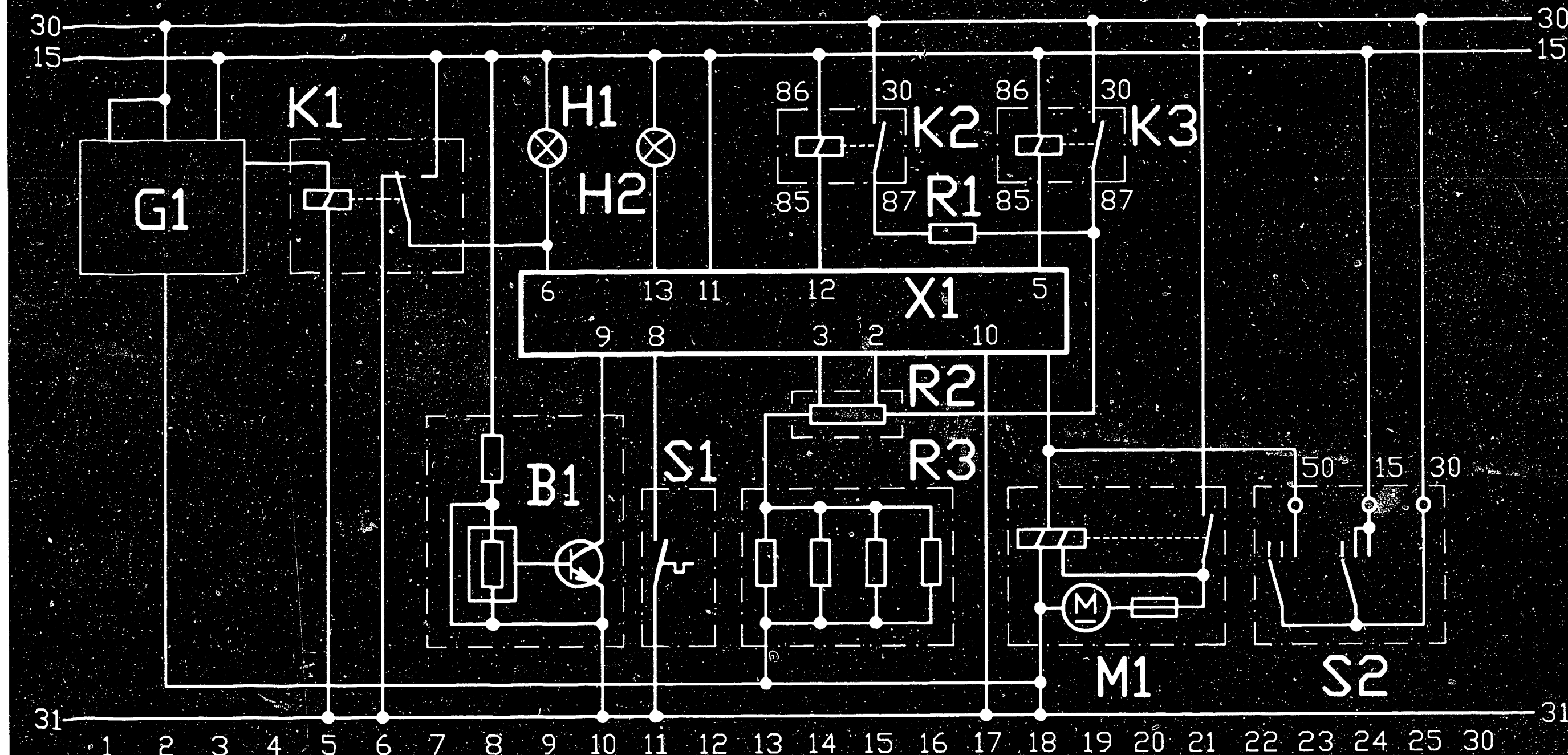
Tensioning torque for  
toothed-belt tensioning roller 25 Nm

Upper toothed-belt casing 10 Nm

Injection-pump holder 45 Nm

Air-filter housing 25 Nm

Nozzle return line 35 Nm



460/1818

B1 = Sensor (distance travelled)  
 G1 = Alternator  
 H1 = Charge indicator pump  
 H2 = Preheating indicator lamp  
 K1 = Relay (charge indicator lamp)  
 K2 = Relay (series resistor)

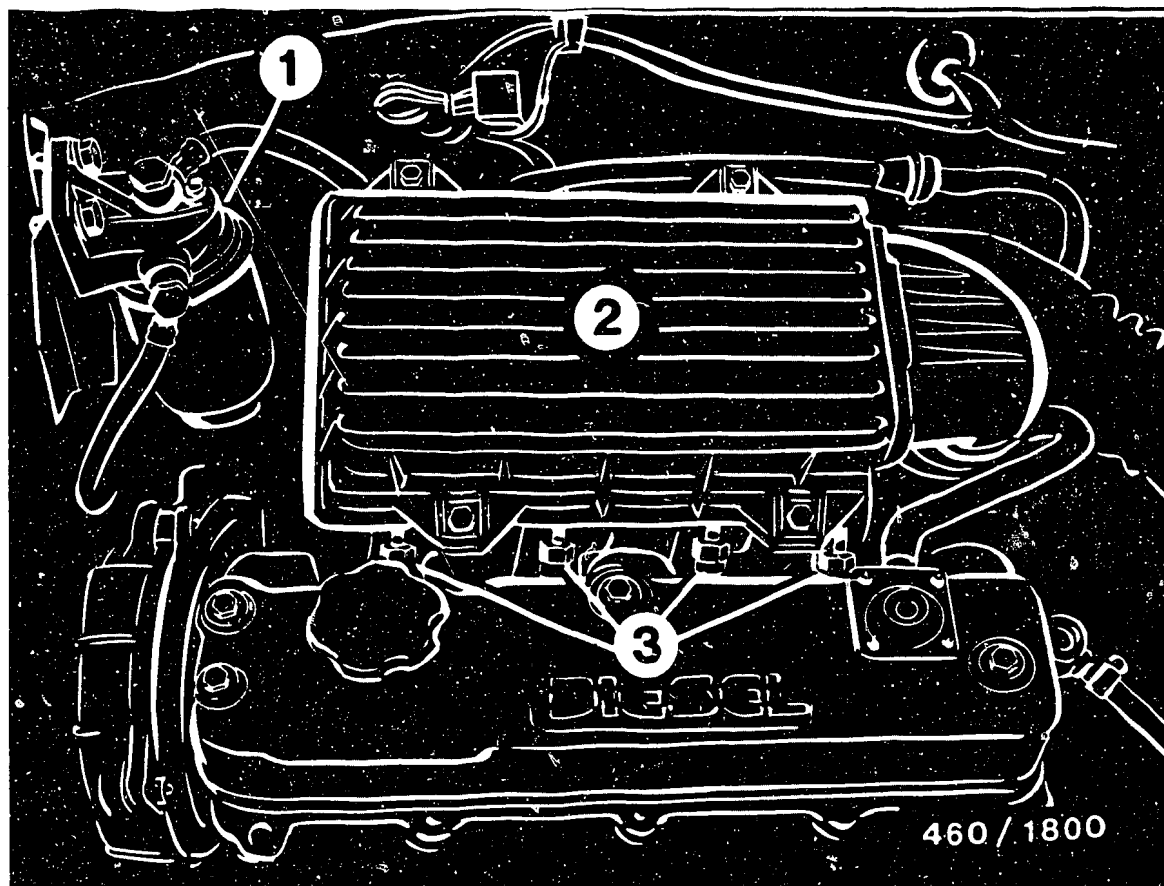
K3 = Relay (measuring resistor)  
 M1 = Starting motor  
 R1 = Series resistor  
 R2 = Measuring resistor  
 R3 = Sheathed-element glow plugs

S1 = Switch, temperature sensor (engine)  
 S2 = Ignition and starting switch  
 X1 = Glow-duration control unit

ELECTRICAL TERMINAL DIAGRAM - PREHEATING SYSTEM

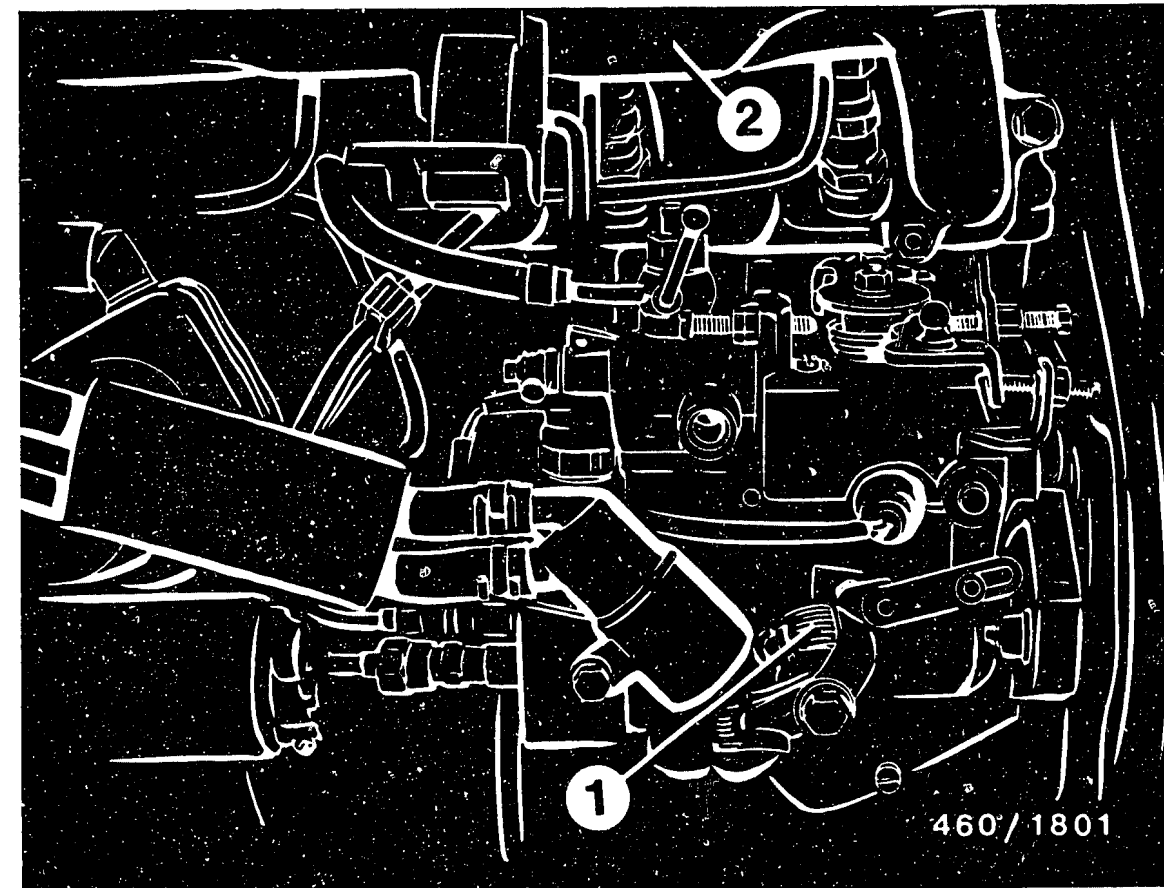
K09

K10



- 1 = Fuel filter
- 2 = Air-filter housing
- 3 = Injection nozzles

INSTALLATION POSITION OF COMPONENTS



- 1 = Temperature controlled  
cold start injection advance (KSB)
- 2 = Intake manifold

INSTALLATION POSITION OF COMPONENTS



## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
2. Engine hunts when idling
3. Rough idling with warm engine
4. High fuel consumption in conjunction with inadequate engine power and smoke formation
5. Inadequate performance
6. Black fumes in full-load range in conjunction with hard engine running, possible loss of power
7. Hard engine running

Cause (component fault)				
*	*		*	Tank empty, tank ventilation
*	*			Injection sequence not firing sequence
*		*		Inlet/return hollow screws
*				Shutoff device
	*	*		Air in fuel system
*				Paraffin separation
				Leak in fuel lines
*		*		Fuel lines clogged
*		*		Supply lines clogged
		*		Engine air filter
	*			Idle speed
*	*	*	*	Injection nozzle
*				Glow plug system
*		*		Fuel filter
		*	*	Timing device
*	*			Engine compression
		*	*	Pump - engine assignment
		*	*	Engine management

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

8. Engine misfires while driving
9. Engine cannot be shut off
10. Incorrect engine speeds
11. Engine won't rev up when cold
12. High idle or rough engine running at high speed
13. Black fumes in full-load range
14. White fumes in full-load range

Cause (component fault)				
*				Tank empty, tank ventilation
*				Injection sequence not firing sequence
*				Inlet/return hollow screws
*	*			Shutoff device
*				Air in fuel system
*				Paraffin separation
*				Leak in fuel lines
*				Fuel lines clogged
*				Supply lines clogged
		*		Engine air filter
	*			Idle speed
*				Injection nozzle
*				Fuel filter
		*		Timing device
	*			Engine compression
	*	*		Pump - engine assignment
*				Engine management



TESTING GLOW PLUG SYSTEM

The glow plug system of the 23 YD-, 23 YDT - and 23 DTR engines is equipped with a preheating relay with short-circuit-current monitoring and self-diagnosis.

On the glow plug system, faults are indicated by flashing either immediately or after starting depending on the type of fault.

Self-diagnosis test program

Test instructions	Flashing time	Flashing pulses per minute	Start of flashing pulses	Component
Ignition "On"				
a)Engine is not started	1 minute	60 X	after 1 min.	Sheathed-element glow plugs defective
b)Start after glow-plug indicator lamp goes out	1 minute	60 X	after start	Sheathed-element glow plugs defective
c)Premature start	1 minute	60 X	after start	Sheathed-element glow plugs defective
Ignition "On"				
Engine is not started	1 minute	240 X	immediately after ignition on	a) Glow-time relay defective b) Open circuit in lead to sheathed-element glow plug c) Check for open circuit in lead, term. 30, starting motor to glow-time relay
Short-circuit prior to "ignition on" and during starting and safety time	1 minute	60 X	immediately	Sheathed-element glow plug - Check connection G1 and G2 with respect to ground

TEST SPECIFICATIONS

Idle speed:

Engine type	Type of inj. pump	Transmission	Idle speed
2.3 YD	VE..L243	MT	700 + 50 min -1
2.3 YD	VE..L243-2	AT	700 + 50 min -1
2.3 YD	VE..L243-2	AT/AC	800 - 50 min -1
2.3 YD*	VE..L243-5	AT/AC	800 - 50 min -1
2.3 YDT	VE..L156	MT	700 + 50 min -1
2.3 YDT	VE..L156-1	AT	700 + 50 min -1
2.3 YDT	VE..L156-1	AT/AC	800 - 50 min -1
2 3 DTR*	VE..L297	AT/AC	800 - 50 min -1

MT = Mechanical manual transmission  
AT = Automatic transmission  
AC = Air conditioner  
\* = as of model year 89

Pump - engine assignment

Engine setting : TDC at cyl. no. 1

Pump setting :

Engine YD : 0.98 - 0.05 mm after BDC  
YTD : 0.85 - 0.05 mm after BDC  
DTR : 0.85 - 0.05 mm after BDC

Note:

Prior to installation of pump at flywheel mark "P", mark on drive pinion (corresponds to position of keyway on drive shaft) must point towards outlet "D".

Vacuum values, EGR

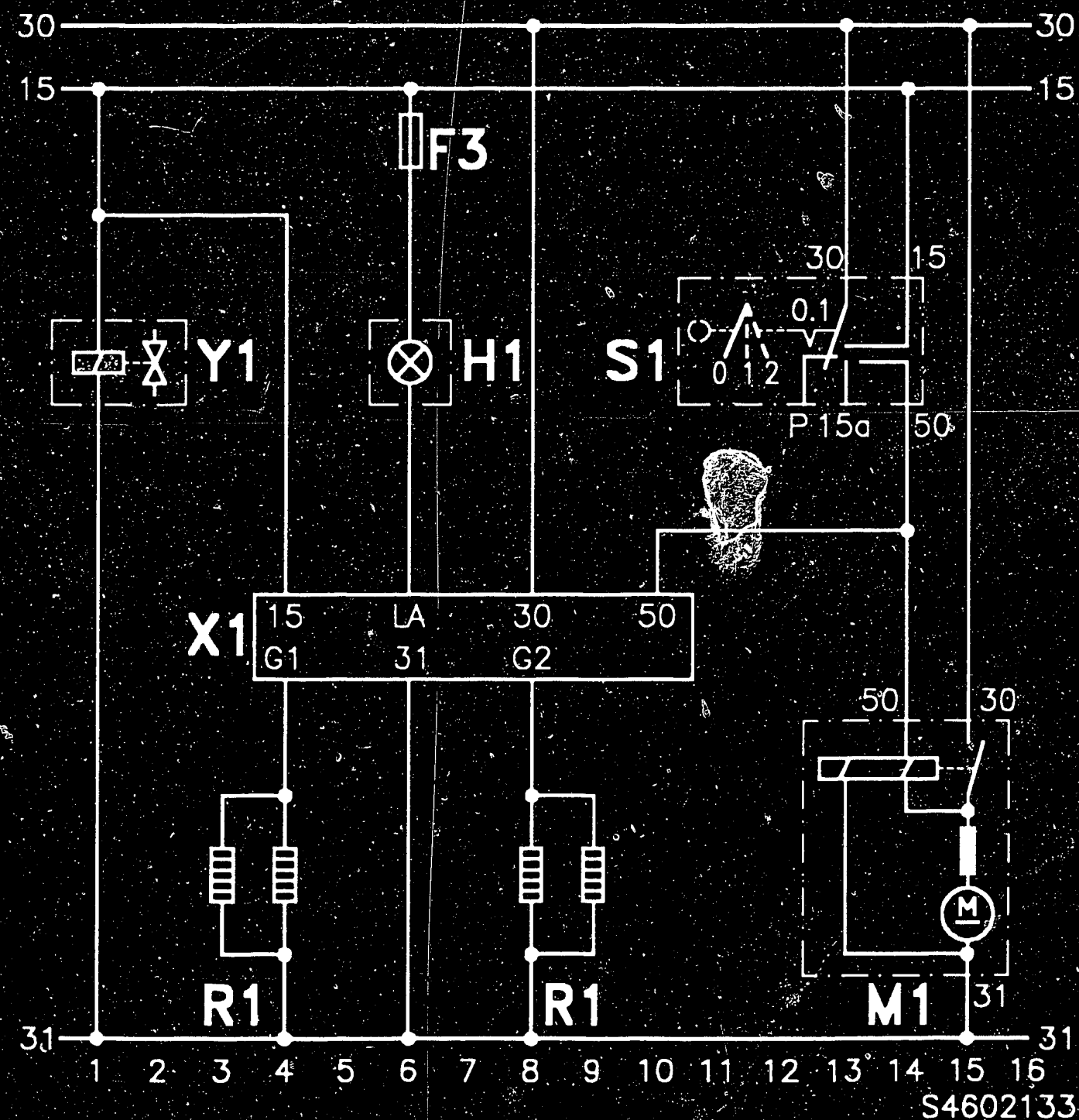
Idle speed:

700...750 min -1 approx. 420 mbar  
4500 min -1 approx. 180 mbar

TIGHTENING TORQUES

Nozzle-holder assembly	70 Nm
Sheathed-element glow plugs	20 Nm
Fastening screws Fuel-injection pump	25 Nm
Nut, driver at fuel-injection pump	55 Nm
Fuel lines	20 Nm
Bleeder screw	20...32 Nm

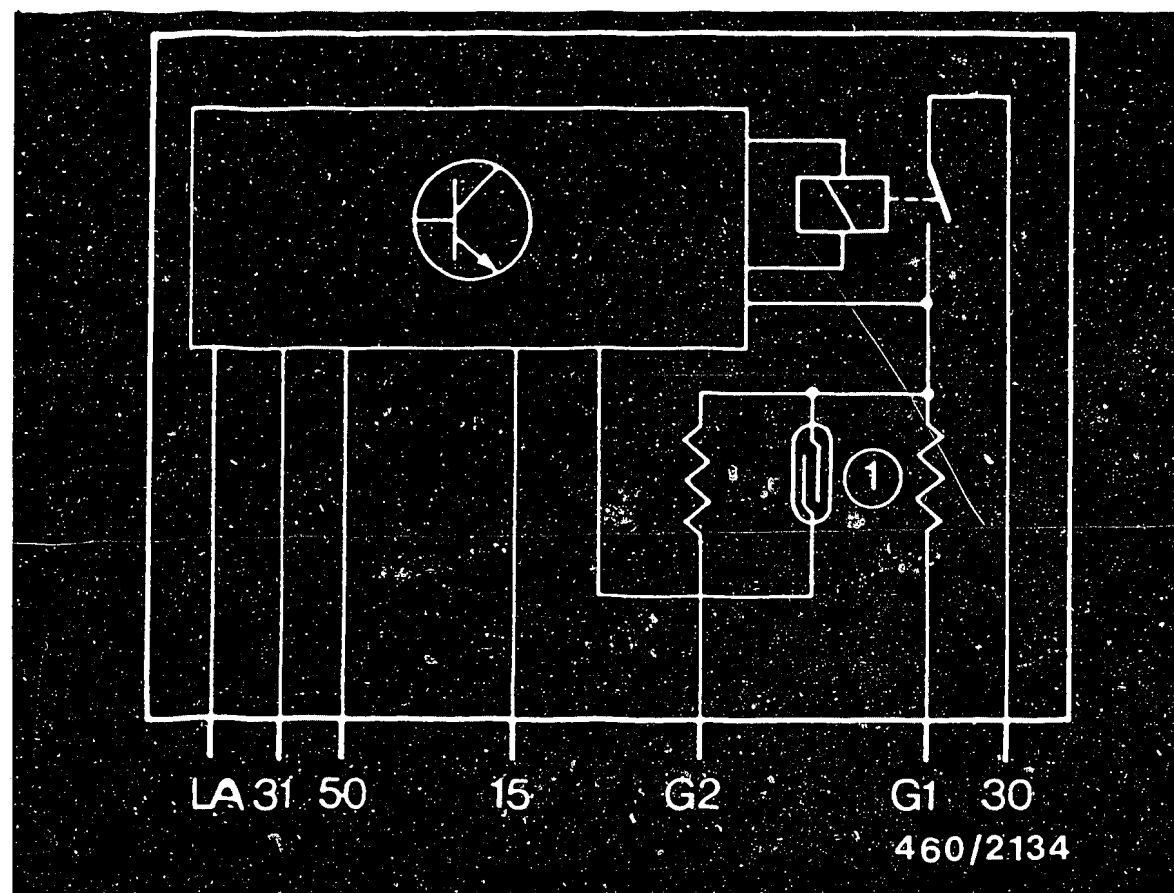




ELECTRICAL TERMINAL DIAGRAM, GLOW PLUG SYSTEM

F3 = Fuse (glow plug system)  
H1 = Glow-plug indicator lamp  
M1 = Starting motor

R1 = Sheathed-element glow plugs  
S1 = Glow-plug and starter switch  
X1 = Glow-duration unit  
Y1 = Solenoid valve (fuel)



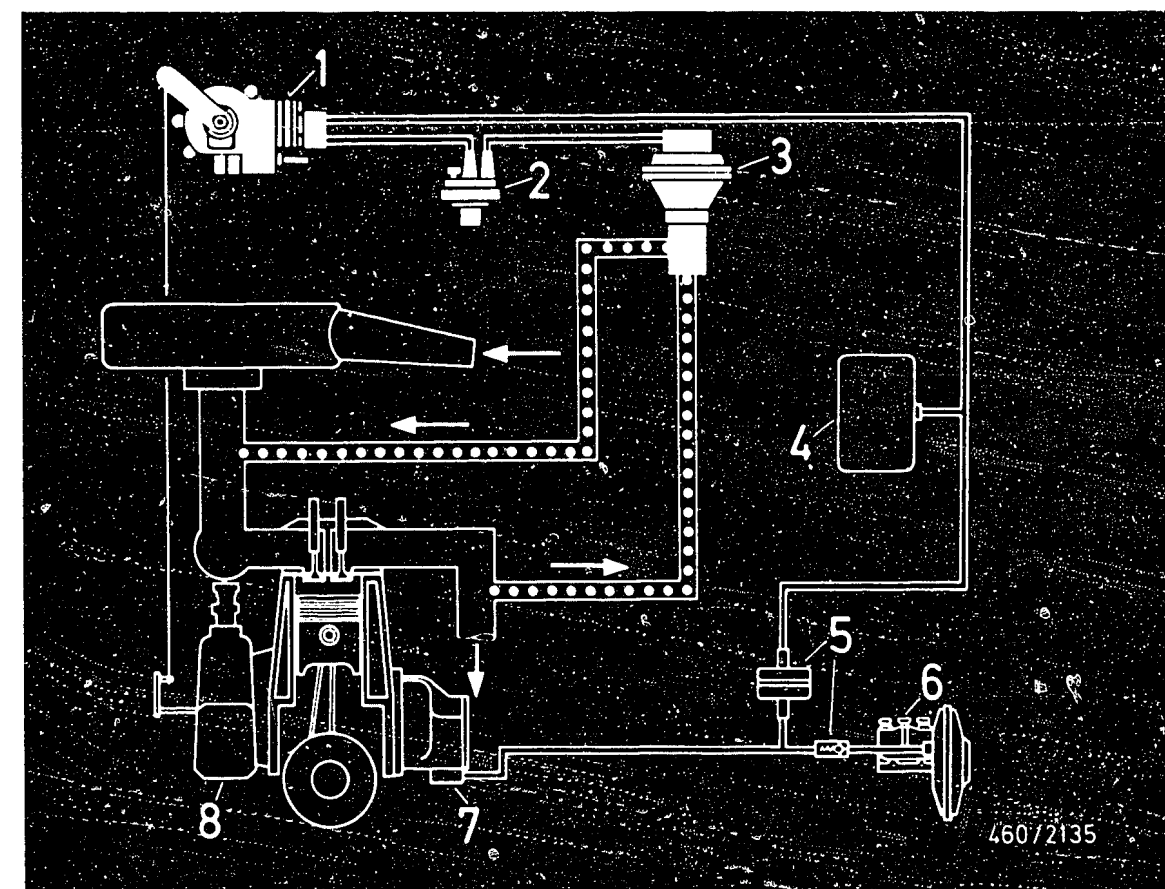
- 1 = Reed contact
- 15 = from ignition lock
- 30 = from starting motor
- 31 = Ground
- 50 = Starting motor
- G1 = Sheathed-element glow plug 1 and 2
- G2 = Sheathed-element glow plug 3 and 4
- LA = Indicator lamp

Note on glow-time relay:

2 sheathed-element glow plugs are supplied with voltage in each case (G1 and G2).

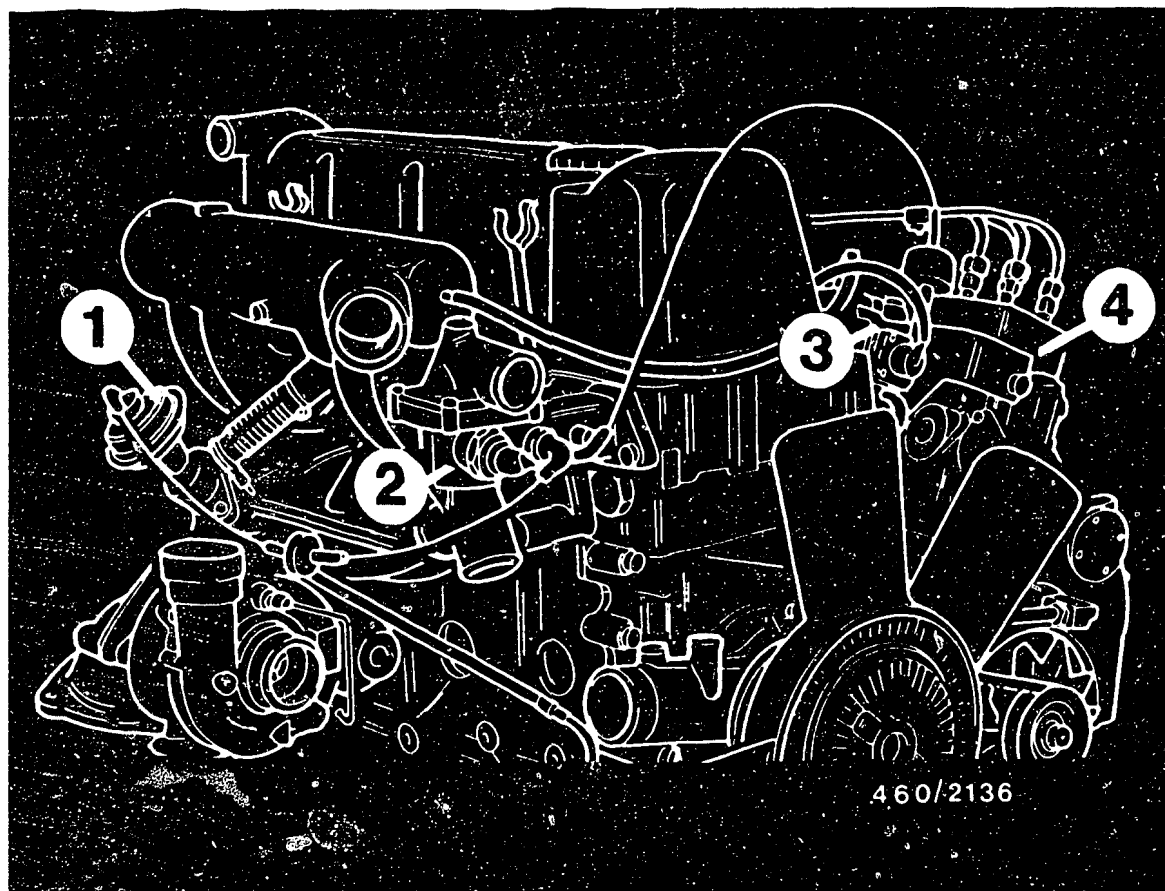
If one sheathed-element glow plug drops out in line G1, a difference voltage is produced and the Reed contact triggers the flashing signal.

If a sheathed-element glow plug likewise drops out at the second line G2, there is no longer any voltage difference and the flashing signal stops.



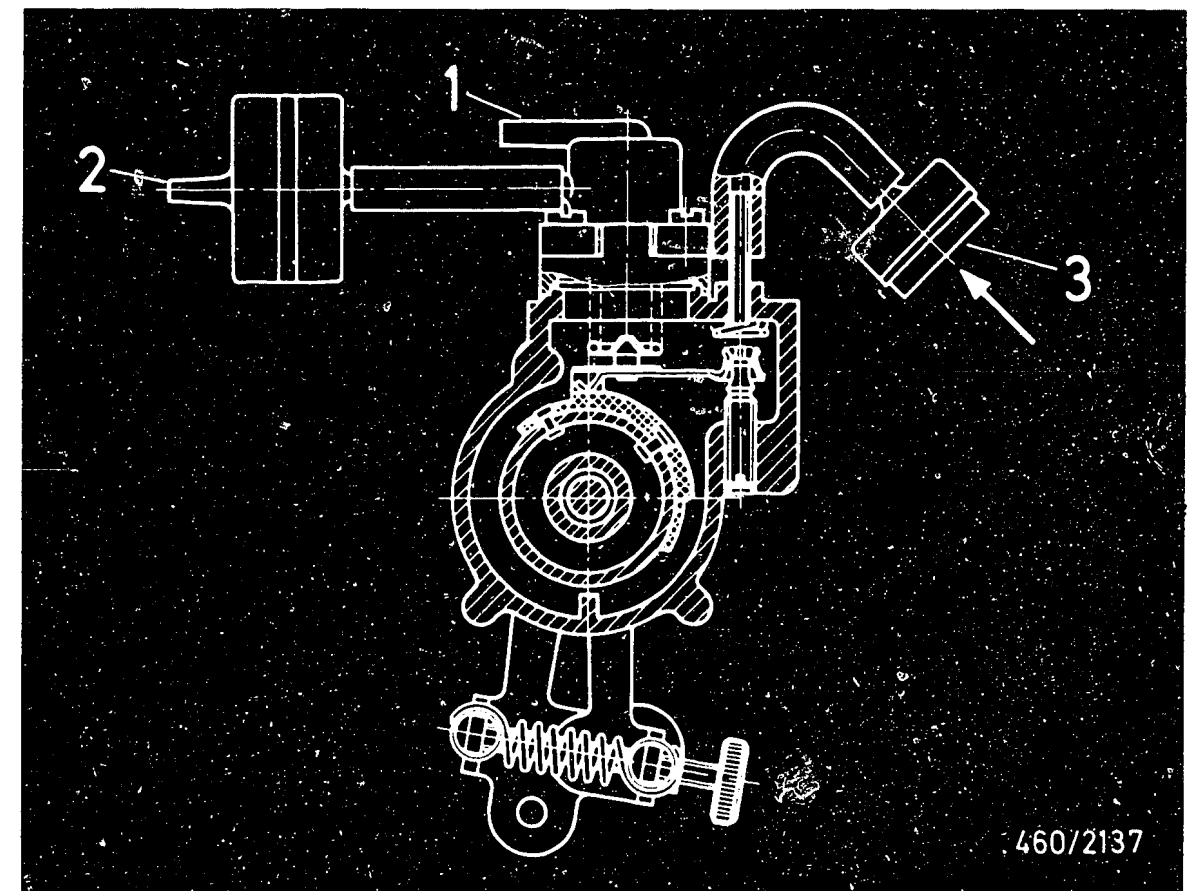
BLOCK DIAGRAM, EGR

- 1 = Mechanical pressure transformer
- 2 = Thermo-valve (coolant)
- 3 = EGR valve
- 4 = Vacuum accumulator
- 5 = Non-return valve
- 6 = Brake booster
- 7 = Vacuum pump
- 8 = Fuel-injection pump



#### INSTALLATION POSITION OF COMPONENTS

- 1 = EGR valve
- 2 = Thermostat housing
- 3 = Pressure transformer
- 4 = Fuel-injection pump



- 1 = Connection, intake end
- 2 = Connection, vacuum tester
- 3 = Vent

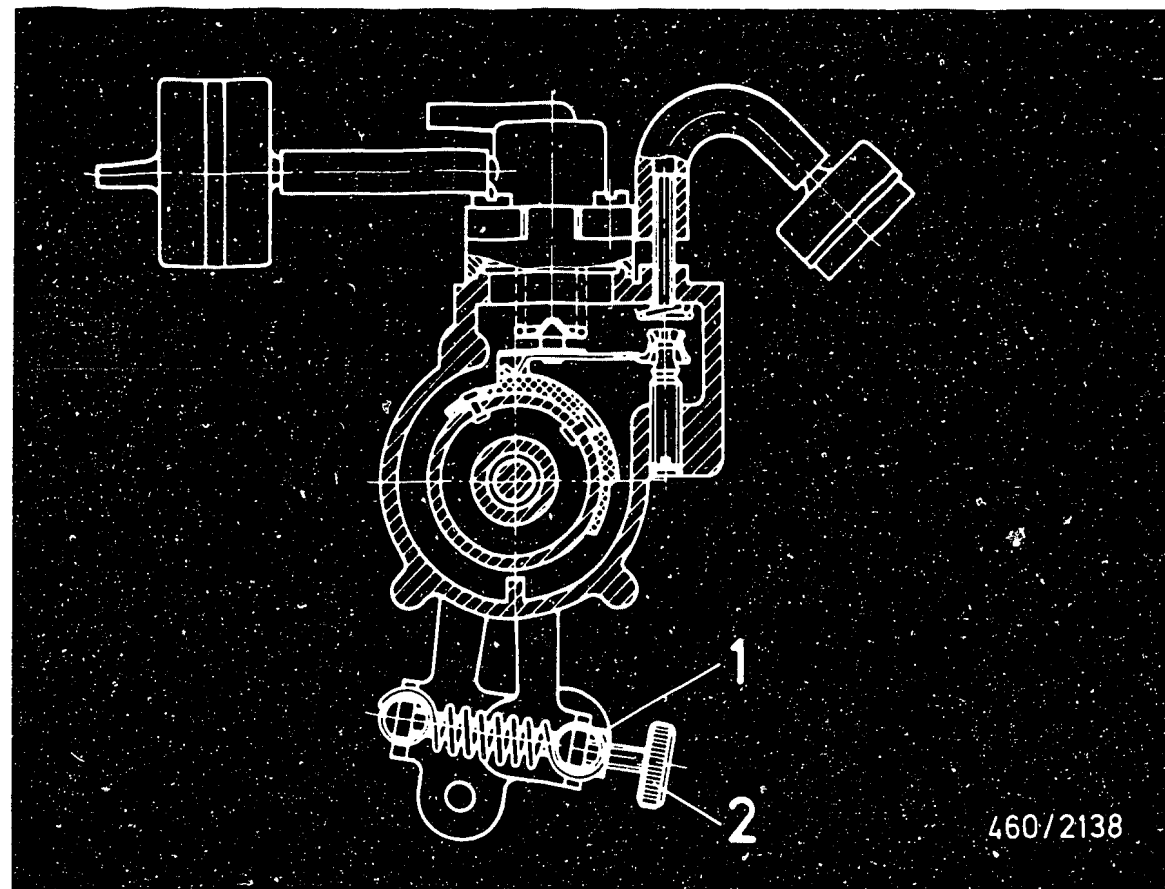
#### TESTING AND ADJUSTING EGR

Run engine at idle speed .

Set value: 700...750 min <sup>-1</sup>

Connect vacuum tester with Y-distributor to connection 2 (mechanical pressure transformer) and read off vacuum value at idle speed.

Set value: approx. 420 hPa



- 1 = Lock nut  
2 = Plastic nut with headless set screw  
(adjusting screw)

For production reasons:  
continued on the following  
coordinate.

Run engine at approx. 4500 min<sup>-1</sup>.

Set value, vacuum: approx. 180 hPa

If vacuum values are not attained, loosen lock nut  
and turn plastic nut with headless set screw.

Tighten lock nut and repeat measurement.

Trouble-shooting instructions : PEU - 5002  
Bosch system : VE - EDC  
Vehicle make : PEUGEOT  
Basic microcard : FZD-00..

T A B L E O F C O N T E N T S

Section	Coordinates
Special features, safety, use.....	02
Trouble-shooting chart.....	04
Self-diagnostics, self-diagnostics test table.....	07
Test specifications.....	25
Electrical terminal diagram, EDC.....	27
Installation position of components, instructions on removal and installation.....	see basic instructions

SPECIAL FEATURES

These brief instructions apply to the following Peugeot model current at the time of writing:

505 Turbo-Diesel  
with electronic control of diesel fuel injection (EDC = Electronic Diesel Control)

Engine: XD3T 2.5 l, 70 kW (95 bhp)  
EU, USA 03.87 ->

USE

These brief instructions essentially contain vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to the various causes/component defects on the basis of the customer complaint. Detailed instructions on trouble-shooting can be found using the trouble-shooting chart of the basic instructions.

NOTE:  
The nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding even when reference is made to a basic instruction.



## SAFETY AND PRECAUTIONARY MEASURES

Always observe these measures in order to prevent damage to the engine, control units and peripheral components of the EDC.

1. For testing the compression, disconnect the 7-pin connector from the distributor-type-fuel injection pump.
2. In the case of nozzle-holder assemblies inductive start-of-injection sensor, the after-sales service workshop is permitted to perform only a correction of the nozzle-opening pressure.
3. Never start the engine if the battery is not firmly connected.
4. Do not use a fast charger for starting the engine.  
Provide starting assistance only using a second 12 V battery and jumper cables.
5. Before fast charging, disconnect the battery from the vehicle electrical system.
6. Never disconnect the battery from the vehicle electrical system when the engine is running.
7. Never disconnect or connect the control-unit plug when the ignition is switched on.
8. At temperatures above + 80° C (paint-drying installation), remove the control units.
9. When welding (electric spot welding), remove the control units.

## TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Trouble lamp lights up/blinks
2. Starting motor operates, engine does not start or starts only with difficulty (hot or cold)
3. Engine surges in idle
4. Uneven idle with engine warm
5. Excessive fuel consumption together with inadequate engine power and smoke formation
6. Unsatisfactory performance
7. Black smoke in full-load range together with rough engine running, poss. insufficient power
8. Rough engine running

					Cause (component fault)
*					Self-diagnostics
	*				Voltage supply, control units
	*				Electromagnetic actuator for quantity
*					Angle potentiometer
*					ELAB
*			*	*	Computer monitoring
			*	*	Solenoid-valve - start of injection
			*		EGR pressure transducer
			*		Nozzle-holder assemblies with NMS
			*		Computer linkage
	*			*	Engine-speed sensor
*					Engine-speed sensor and NMS
*					Tank empty, tank ventilation
*		*		*	Injection sequence not ignition sequence
	*				Reducer bushing, supply/return flow
*		*			Air in fuel system
*					Paraffin deposits
*			*		Leakage in fuel lines
*					Supply lines blocked
*		*	*	*	Fuel-injection nozzles
*		*	*	*	Pump-engine coordination
*					Fuel filter
*					Preheating system
*		*	*		Compression - engine
*	*	*	*	*	Fuel-injection pump
			*		Engine air filter
			*		Engine timing
				*	Timing device
			*		Turbo-supercharger

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (symptom of trouble)

9. Engine missing during vehicle operation
10. Engine cuts off automatically
11. Engine runs at constant speed
12. Engine will not rev up in cold condition
13. Increased idle speed or uneven engine running at high engine speeds
14. Black smoke in full-load range
15. Fog-like smoke (white) in full-load range

					Cause (component defect)
	*				Accelerator pedal
*					Electromagnetic actuator for quantity
*			*		Angle potentiometer
*					Computer monitoring
*					Engine-speed sensor and NMS
*	*	*		*	Tank empty, tank ventilation
	*	*		*	Injection sequence not ignition sequence
*		*		*	Reducer bushings supply/return flow
*		*		*	Air in fuel system
		*			Paraffin deposits
*					Leakage in fuel lines
*		*		*	Supply lines plugged
		*		*	Pump-engine coordination
		*		*	Fuel filter
		*			Compression, engine
		*		*	Fuel-injection pump
			*		Exhaust-gas recirculation

## TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

- 16. Cruise control (FGR) not functioning
- 17. Cruise control cannot be switched off
- 18. Road speed cannot be reassumed
- 19. Exhaust-gas recirculation not functioning

					Cause (component defect)
		*			Computer monitoring
		*			Solenoid-operated valve - start of inj.
		*			EGR pressure transducer
		*			Nozzle holders with NMS
*		*			Engine-speed sensor
*		*			Road-speed sensor
*					Transmission-shift valve
*					Cruise-control ON switch
*	*				Clutch/brake switch
	*				Cruise-control OFF switch
	*				Cruise-control ACTIVATE switch
		*			Air-flow sensor
		*			Temperature sensor - air
		*			Temperature sensor - engine

## TROUBLE-SHOOTING

### \* Using the self-diagnosis

The control units of the electronically controlled diesel fuel injection (EDC = Electronic Diesel Control) have a self-diagnosis system at their disposal for the purpose of detecting defective peripheral components and/or line paths.

Therefore, always begin trouble-shooting (testing) with self-diagnosis.

If several faults are present and can be called up in turn via the self-diagnosis, make a note of the flashing-code data. If the voltage supply for the control units is interrupted, the faults stored are cleared. As a result, faults which momentarily cannot be registered (e.g. intermittently occurring loose contacts) cannot be identified as the cause of trouble.

If a faulty function path is indicated, pay particular attention to:

- \* Loose contacts at multiple plug
- \* Fouled, deformed or corroded plug-in contacts.
- \* Breaks in leads at kinked or pinched locations.

### Test information:

Before disconnecting or connecting control-unit plugs, switch off the ignition.

Clear the flashing code of the fault stored and trigger self-diagnosis once again as a check.

## SELF-DIAGNOSIS VIA FLASHING-CODE EVALUATION

An integrated self-diagnosis system in the two control units (output through control unit 2 only) makes it possible to locate a faulty component or line path via a flashing code. Indication is given by means of an indicator lamp in the instrument panel, this lamp lighting or flashing in the case of a fault (illustration a).

The diagnostic program is activated by pressing the diagnostic button (Test).

The program then starts with a start code 1.2 (= 1 flashing pulse - pause - 2 flashing pulses) and ends with an end code 1.1.

## Flashing-code evaluation

1. Actuate the diagnostic button (Test) for at least 1 second in order to avoid incorrect tripping.
2. Start code 1.2 of the diagnosis program is indicated.
3. Wait until the indicator lamp lights up again and then actuate the test switch once again.
4. Flashing code of the corresponding faulty component is indicated.
5. Actuate the diagnostic button again. If there is no further fault, the end code 1.1 is indicated.

## Clearing the flashing code

1. Switch on the ignition.
2. Actuate the brake pedal and test switch simultaneously for at least 1 second.
3. Call up the diagnosis program anew by pressing the diagnostic button.
4. If the end code 1.1 is indicated after the start code 1.2, the stored flashing code for the respective faulty component is cleared.

## \* Breakdown of self-diagnosis (flashing code)

- 1.1 Program end code
- 1.2 Program start code
- 1.3 Temperature sensor (intake air) \*
- 1.4 Temperature sensor (coolant) \*
- 1.5 Fuel-temperature sensor \*
- 2.1 Accelerator pedal
- 2.2 Rotational-angle potentiometer
- 2.3 Delivery controller
- 2.4 Road-speed sensor \*
- 2.5 Pressure transducer, road-speed control \*
- 3.1 Atmospheric-pressure sensor \*
- 3.3 Air-flow sensor
- 3.4 Pressure transducer, exhaust-gas recirculation
- 4.1 Engine-speed sensor
- 4.2 Needle-movement sensor
- 4.3 Solenoid-operated-valve start of injection
- 5.1 Computer interface, control unit (stored fault)
- 5.2 Computer interface, control unit (present fault) and/or computer monitoring, control unit 1

Steady light (flashing code cannot be called up)  
Computer monitoring, control unit 2

## N o t e:

\* = Slight fault, indicator lamp of self-diagnosis goes out 30 seconds after the engine has been started.

## SELF-DIAGNOSIS TEST TABLE

Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
1.3	Temperature sensor (intake air)	Test resistance at air-flow sensor at +15...+30°C. Test measurement voltage (control unit) at disconnected cable connector.	1 - 4  1 - 4	1.3...3.6 k $\Omega$  approx. 5 V
1.4	Temperature sensor (coolant)	Test resistance at component. +15...+30°C: approx. 80°C:  Test measuring voltage (control unit) at disconnected cable connector.		1.3...3.6 k $\Omega$ 250...390 $\Omega$  approx. 5 V
1.5	Temperature sensor, fuel	Carry out tests at 7-pin cable plug for the EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.  * Ground connection Connect adapter to cable connector for fuel-injection pump  * Short circuit Connect adapter to cable connector for fuel-injection pump  * Internal resistance at +15...+30°C: (Connect adapter to cable connector for fuel-inj. pump)  * Measuring voltage (control unit): (Connect adapter to cable connector for control unit)	5 - gr. 6 - gr.   4 - 6 5 - 6  5 - 6	> 1 M $\Omega$ > 1 M $\Omega$  > 1 M $\Omega$ 1.2...4.0 k $\Omega$  approx. 5 V
2.1	Accelerator pedal	Carry out tests on component.  * Internal resistance  * Supply voltage  * Voltage signal - idle position - full-load position	1 - 3  1 - 3 (-) (+) 1 - 2 1 - 2	1.6...2.4 k $\Omega$  4.8...5.2 V 0.45...0.55 V 4.00...4.50 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

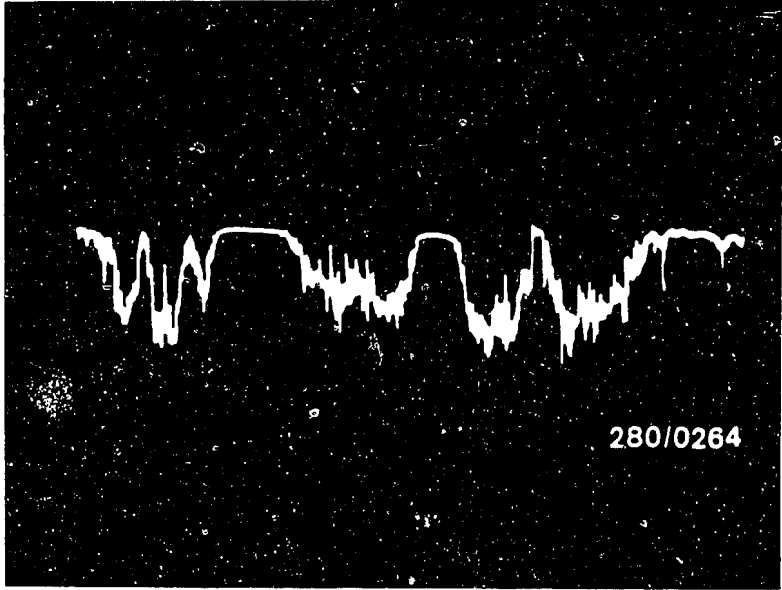
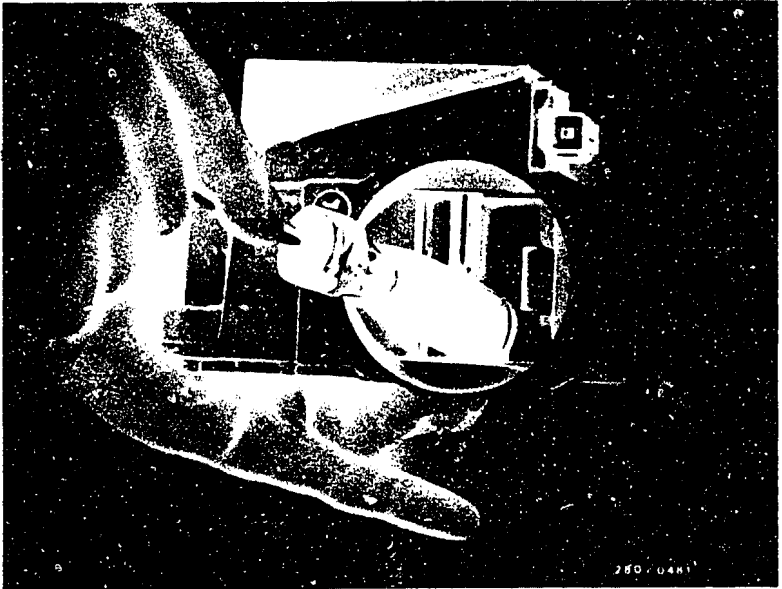
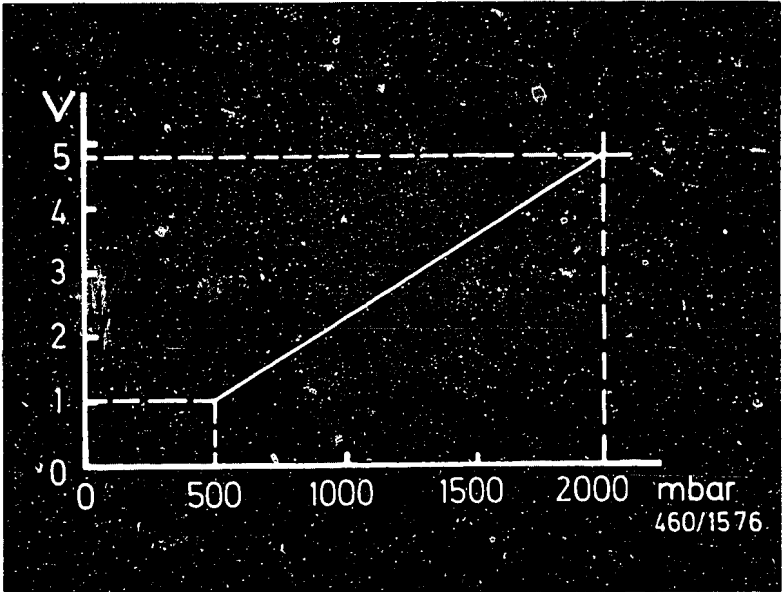
Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
2.2	Angle potentiometer	<p>Carry out tests at 7-pin cable connector of EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.</p> <p>* Ground connection Connect adapter to cable connector for fuel-injection pump</p> <p>* Short circuit Connect adapter to cable connector for fuel-injection pump</p> <p>* Resistance - potentiometer path Connect adapter to cable connector for fuel-inj. pump.</p> <p>* Resistance - slider path Connect adapter to cable connector for fuel-inj. pump.</p> <p>* Supply voltage Connect adapter to cable connector for control unit.</p> <p>* Voltage signal Connect both cable connectors to adapter. Disconnect cable connectors at temperature sensor 2 (engine) and needle-motion sensor (NMS).  Plug in cable connector to NMS.</p>	<p>1 - gr. &gt; 1 M <math>\Omega</math> 2 - gr. &gt; 1 M <math>\Omega</math> 3 - gr. &gt; 1 M <math>\Omega</math></p> <p>2 - 7 &gt; 1 M <math>\Omega</math></p> <p>2 - 3 1.0...10.0 k <math>\Omega</math></p> <p>1 - 3 500 <math>\Omega</math> ...5.00 k <math>\Omega</math></p> <p>2 - 3 4.8...5.2 V (+) (-)</p> <p>1 - 3</p>	<p>&gt; 3.0 V</p> <p>2.0...2.3 V</p>

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
2.3	Quantity control	Carry out testing at 7-pin cable connector for EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.  * Ground connection Connect adapter to cable connector for fuel-inj. pump.  * Internal resistance Connect adapter to cable connector for fuel-inj. pump.  * Supply voltage Connect adapter to cable connector for control unit.	4 - gr. > 1 M $\Omega$ 7 - gr. > 1 M $\Omega$  4 - 7 0.3...1.2 $\Omega$  3 - 7 8.0...14.5 V (-) (+)	
2.4	Road-speed sensor	Test internal resistance at components at +15...+50°C.  Test measuring voltage (control unit) at disconnected cable connector.		240...350 $\Omega$  approx. 5 V
2.5	Cruise-control pressure transducer	Test internal resistance at components at approx. +20°C.  Test measuring voltage (control unit) at disconnected cable connector.		5.0...6.0 $\Omega$  approx. 12 V

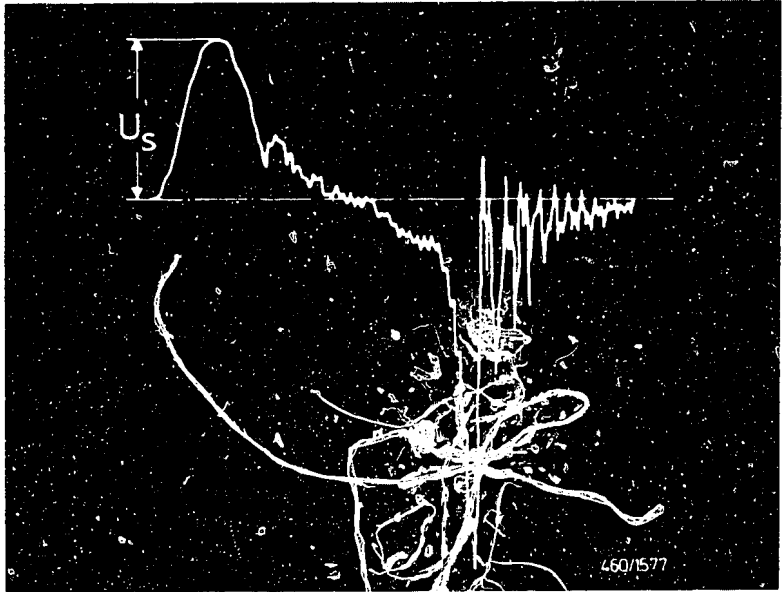
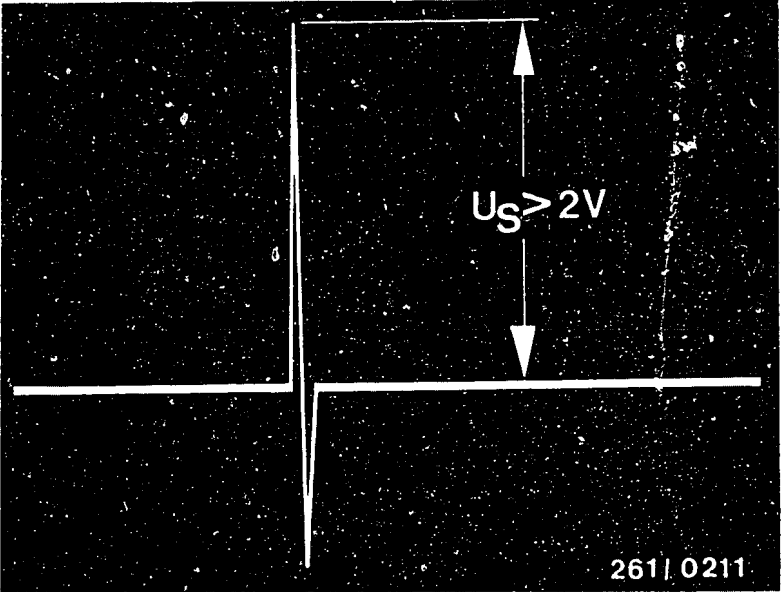
SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function Test instructions/conditions	Terms.	Nominal values
3.1	Atmospheric-pressure sensor. Carry out testing at component. * Supply voltage * Voltage signal (find out barometric pressure)	1 - 3 1 - 2	4.8...5.2 V see characteristic curve
3.3	Air-flow sensor. Carry out testing at component. * Overall resistance * Supply voltage  * Voltage signal - By changing the air-flow sensor flap position * Noise test - Motortester, special input	3 - 4 3 - 4 (+) (-) 2 - 4  2 - 4	500...1000 $\Omega$ 4.8...5.2 V  0.25...4.65 V  Noise signal in case of defective air-flow sensor (see illustration)
3.4	Exhaust-gas recirculation press. transd. * Test internal resistance at component at approx. + 20°C. * Test measuring voltage (control unit) at component cable connector * Actuation on-off ratio - Coolant temperature approx. + 80°C - Connect pocket tester to pressure transducer - Set for dwell angle - Operate engine at idle speed  - Disconnect cable connector at temperature sensor (coolant) or air-flow sensor. Note for testing: The on-off ratio should change when one of the components is unplugged.		5.0...6.0 $\Omega$  approx. 12 V  Tester shows the on-off ratio  0...10 %





Defect-indic. Blink code	Testing of component/function Test instructions/conditions	Terms.	Nominal values
4.1	<p>Engine-speed sensor</p> <p>Carry out tests on component cable connector.</p> <ul style="list-style-type: none"><li>* Ground connection</li><li>* Internal resistance at approx. + 20°C</li><li>* Engine-speed signal image<ul style="list-style-type: none"><li>- Motortester, special input</li><li>- Operate engine at idle speed</li></ul></li></ul> <p>Note: Positive signal peak must come first</p>	1 - 2 (+) (-)	<p>&gt; 1 M <math>\Omega</math></p> <p>900...1100 <math>\Omega</math></p> <p>see upper signal image</p>
4.2	<p>Needle-motion sensor - carry out tests on component cable connector.</p> <ul style="list-style-type: none"><li>* Ground connection</li><li>* Internal resistance approx. + 20°C approx. + 80°C</li><li>* Supply voltage<ul style="list-style-type: none"><li>- Cable connector disconnected</li><li>- Cable connector connected at approx. + 80°C</li></ul></li><li>* Valve-lift signal/signal voltage (<math>U_s</math>)<ul style="list-style-type: none"><li>- Cable connector connected</li><li>- Operate engine at idle speed</li><li>- Motortester special input, or use oscilloscope</li></ul></li></ul>		<p>&gt; 1 M <math>\Omega</math></p> <p>90...110 <math>\Omega</math> 111...135 <math>\Omega</math></p> <p>10.0...12.0 V 2.5... 6.0 V</p> <p>See signal image</p> <p><math>U_s = &gt; 150</math> mV</p>



SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function	Test instructions/conditions	Terms.	Nominal values									
4.3	Start-of-injection solenoid-operated valve	<p>Carry out testing on component cable connector.</p> <ul style="list-style-type: none"><li>* Ground connection</li><li>* Internal resistance at approx. +60°C</li><li>* Test measuring voltage (control unit) at disconnected cable connector.</li><li>* Actuation on-off ratio<ul style="list-style-type: none"><li>– Coolant temperature approx. + 80°C</li><li>– Connect pocket tester to connected cable connector</li><li>– Set for dwell angle</li><li>– Operate engine at idle speed</li><li>– Unplug cable connector from needle-motion sensor</li></ul></li><li>– Plug in cable connector to needle-motion sensor</li></ul> <p>Note for testing: The on-off ratio should change when the needle-motion sensor plug is disconnected or when the engine speed increases</p>		<p>&gt; 1 M Ω</p> <p>13.0...22.0 Ω</p> <p>approx. 12 V</p> <p>10...30 %</p> <p>20...40 %</p>									
5.1	Computer link, control unit (fault in memory)	<p>Fault not occurring at time of testing. Disconnect control-unit plugs 1 and 2.</p> <p>Test the following leads for open circuits or contact resistance:</p> <table><tr><td>Control-unit plug 1</td><td></td><td>Control-unit plug 2</td></tr><tr><td>Term.14</td><td>to</td><td>term.9</td></tr><tr><td>Term.15</td><td>to</td><td>term.12</td></tr></table>	Control-unit plug 1		Control-unit plug 2	Term.14	to	term.9	Term.15	to	term.12		approx. 0 Ω
Control-unit plug 1		Control-unit plug 2											
Term.14	to	term.9											
Term.15	to	term.12											

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect indic. Blink code	Testing of component/function	Test instructions/conditions	Terms.	Nominal values
5.2	Computer linkage, control unit (current fault)	Fault is present at time of testing. Disconnect cable connector at control-unit plugs 1 and 2.  Test the following leads for open circuits and/or contact resistance:  Control-unit plug 1                      Control-unit plug 22 Term.14                      to                      term.9 Term.15                      to                      term.12		approx. 0 Ω
5.2	Computer monitoring, control unit 1	There is a defect in the computer monitoring only if the engine <u>cannot</u> be started with the indicated blink code. Replace control unit 1.		
Continuous light	Computer monitoring, control unit 2	Self-diagnosis indicator lamp lights up and stays lit, and no blink code is indicated when the test button is pressed.  Exhaust-gas recirculation switched off.  Disconnect cable connector from start-of-injection solenoid-operated valve. Test measuring voltage (control unit) at cable connector.		approx. 12 V

## TEST SPECIFICATIONS

Component/function	Nominal values
Idle speed:	
* Eng. at op. temp. (approx. +80°C)	730... 830 min <sup>-1</sup>
* Engine cold	950...1050 min <sup>-1</sup>
Nozzle-opening pressure:	150 + 8 bar
Coordination of pump and engine:	
Setting value engine position	4th cylinder 1.07 mm before TDC
Inspection value engine position	4th cylinder 1.04...1.10 mm before TDC
Setting value pump position	0.30 mm after BDC
Inspection value pump position	0.28...0.32mm after BDC
Charge-air pressure:	0.8 bar at full load starting at 2000 min <sup>-1</sup>
Compression:	25...30 bar
Max. cylinder deviation	5 bar

M25

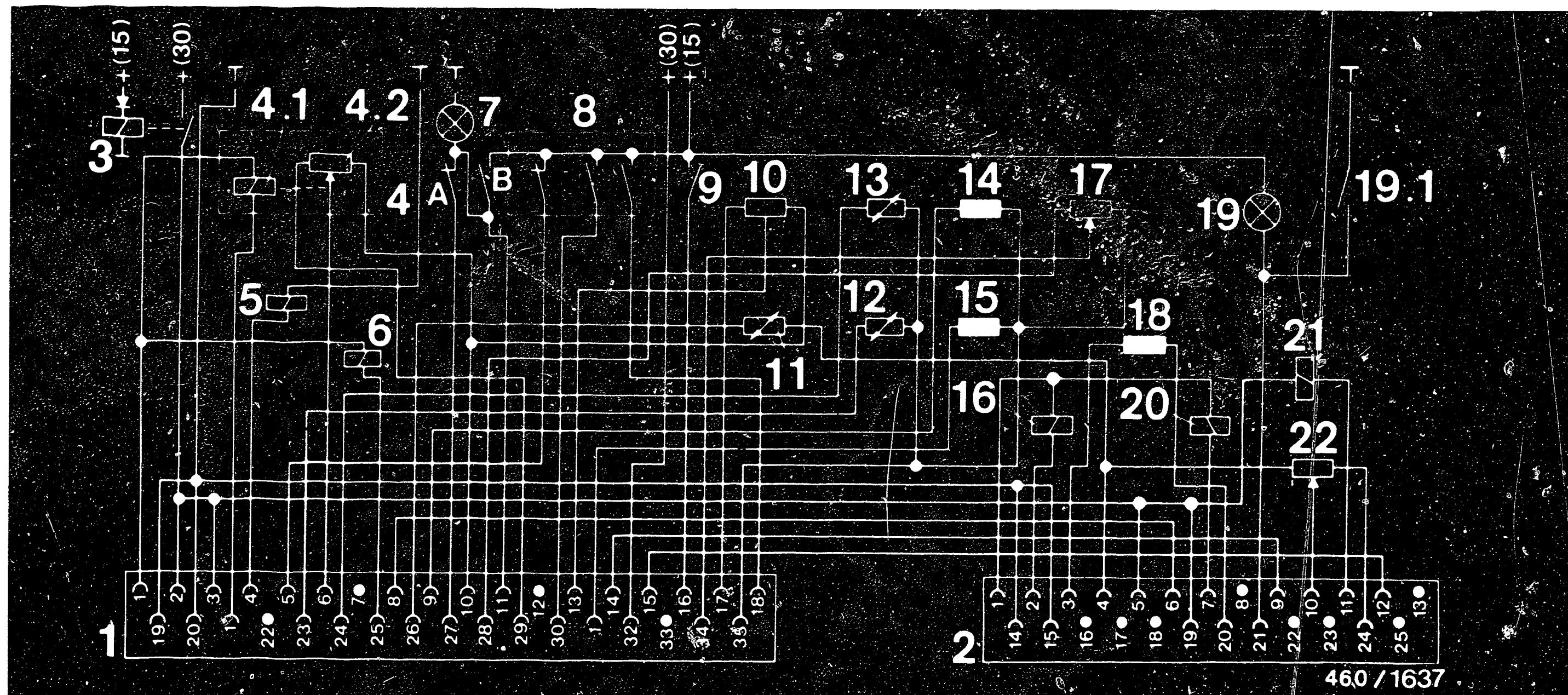


## TEST SPECIFICATIONS (CONTINUED)

Component/function	Nominal values
Valve clearance – exhaust – intake	0.25...0.30 mm 0.15...0.20 mm
Engine temperature approx. + 20°C	
Filter test, max. allowable differential pressure:	0.3 bar
Pressure drop:	max. perm. 25 %
Transmission-shift valve Internal resistance	28...32 Ω
Tightening torques	
Fuel lines	25 Nm
Fastening screws/ fuel-injection pump	20 Nm
Fastening screws/nozzle- holder assemblies	70 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Adjusting screw – rocker arm	15 Nm
Fastening nut/ crankshaft belt pulley	170 Nm
Cylinder-head cover screws	7.5 Nm

M26





A = Switch, clutch  
 B = Switch, brakes  
 1 = Quantity/road-speed control unit (1)  
 2 = EGR/start-of-injection control unit (2)  
 3 = Reversed-polarity protection relay  
 4 = Fuel-injection pump  
 4.1 = Quantity actuator  
 4.2 = Actuator potentiometer  
 5 = ELAB

6 = FGR pressure transducer \*  
 7 = Stop lamps  
 8 = FGR operating stalk  
 9 = Air conditioner  
 10 = Accelerator pedal  
 11 = Temperature sensor, intake air  
 12 = Temperature sensor, coolant  
 13 = Fuel-temperature sensor  
 14 = Road-speed sensor  
 15 = Engine-speed sensor

16 = Timing device  
 17 = Atmospheric-pressure sensor  
 18 = Needle-motion sensor (NMS)  
 19 = Diagnostic display  
 19.1 = Diagnosis request  
 20 = EGR pressure transducer  
 21 = transmission-shift valve \*  
 22 = Air-flow sensor

\* = only on vehicles with automatic transmission

ELECTRICAL TERMINAL DIAGRAM - EDC

Trouble-shooting instructions : REN-5000

BOSCH system : VE..F.. pump

Make of vehicle : RENAULT

Test instructions	Coordinates
Special features.....	02
Test specifications.....	02
Terminal diagram, preheating system.....	05
Tools.....	07
Removing injection pump.....	08
Installing injection pump.....	13
Checking / Adjusting engine timing.....	21

\* This microcard contains the trouble-shooting instructions, valid at the time of publication, for the following Renault models with diesel engine F8M 1.6 L 44 kW (55 bhp):

Renault R 5	(09.85→)
Renault Express	(03.86→)

2.1 Idle speed:	825...875 min	-1
Fast idle	1100...1200 min	-1

2.2 Nozzle-opening pressure: 130 + 8 bar

### 2.3 Coordination, pump – engine (injection timing):

### 2.3.1 Testing/adjusting "static"

Engine position: Cyl. 1 at TDC

Setting value:

Pump position: 0.63...0.67 mm after BDC

Check value:

Pump position: 0.65 mm after BDC

### 2.3.2 Testing "dynamic"

Engine speed 825...875 min<sup>-1</sup>

Start of injection 10.5...12.5° before TTC

2.4 Compression: min. of 20 bar  
max. error per cylinder 4 bar

## 2.5 Cold-start device

Engine speed	Ambient temp.	Cut-in time	Thermocouple
above 2000 min <sup>-1</sup>	above + 35°C up to +20°C up to -20°C	no function 30 s. 165 s.	23 Ohms

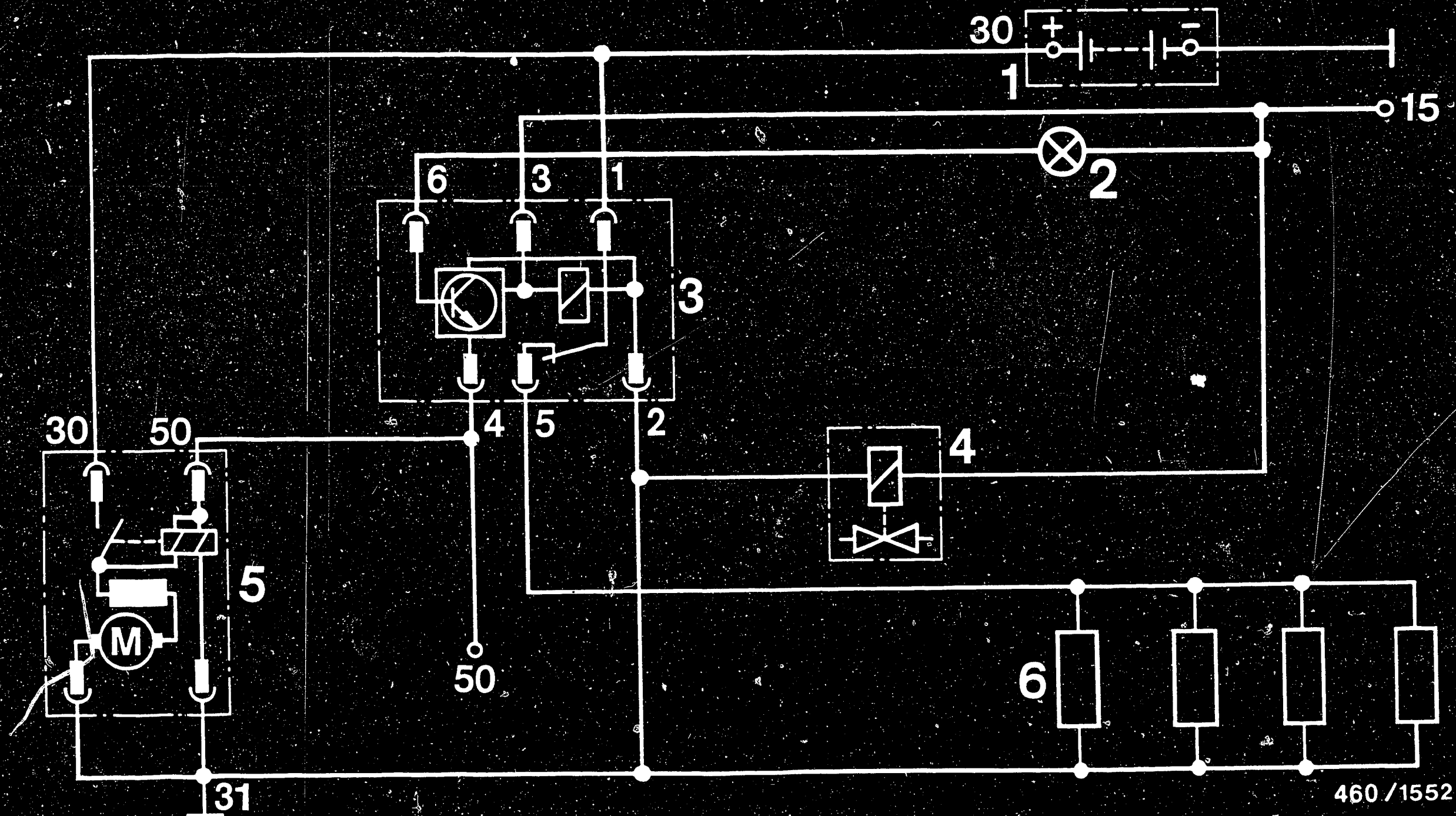
## 2.6 Toothed-belt tension

Scale interval 13...14

2.7 TIGHTENING TORQUES

Injection-pump gear (Hexagon nut)	50 Nm
Fuel lines	25 Nm
Fastening screws of injection Pump	25 Nm
Cylinder-head cover	3...6 Nm
Screw plug	10 Nm
Nozzle-holder assembly	65...75 Nm
Angle bracket of injection pump	25 Nm
Toothed-belt tensioning roller	40 Nm
Hollow screws, fuel lines	25 Nm
Pulley, crankshaft	100 Nm

For production reasons:  
continued on the following  
coordinate.



460/1552

- |                              |                                 |
|------------------------------|---------------------------------|
| 1 = Battery                  | 4 = Solenoid-operated valve     |
| 2 = Preheating repeater lamp | 5 = Starting motor              |
| 3 = Glow-time control unit   | 6 = Sheathed-element glow plugs |

### 3. TERMINAL DIAGRAM FOR PREHEATING SYSTEM



#### 4. TOOLS

Description	Part number	Application
Puller	KDEP 1118	Pulling off injection-pump gear
Setting mandrel	KDEP 1123	Locking crankshaft
Holding device	KDEP 1147	For securing pump drive gear
Measuring tool	KDEP 1085	Coordination, pump - engine
Toothed-belt tester	KDEP 1121	Checking toothed-belt tension
Box wrench	KDEP 1115	Loosening/tightening fuel-injection tubing

\* When using a setting mandrel with overall length of 150 mm, shorten handle length by 50 mm due to altered installation position of engine.



#### 5. REMOVING INJECTION PUMP

Disconnect negative cable at battery.

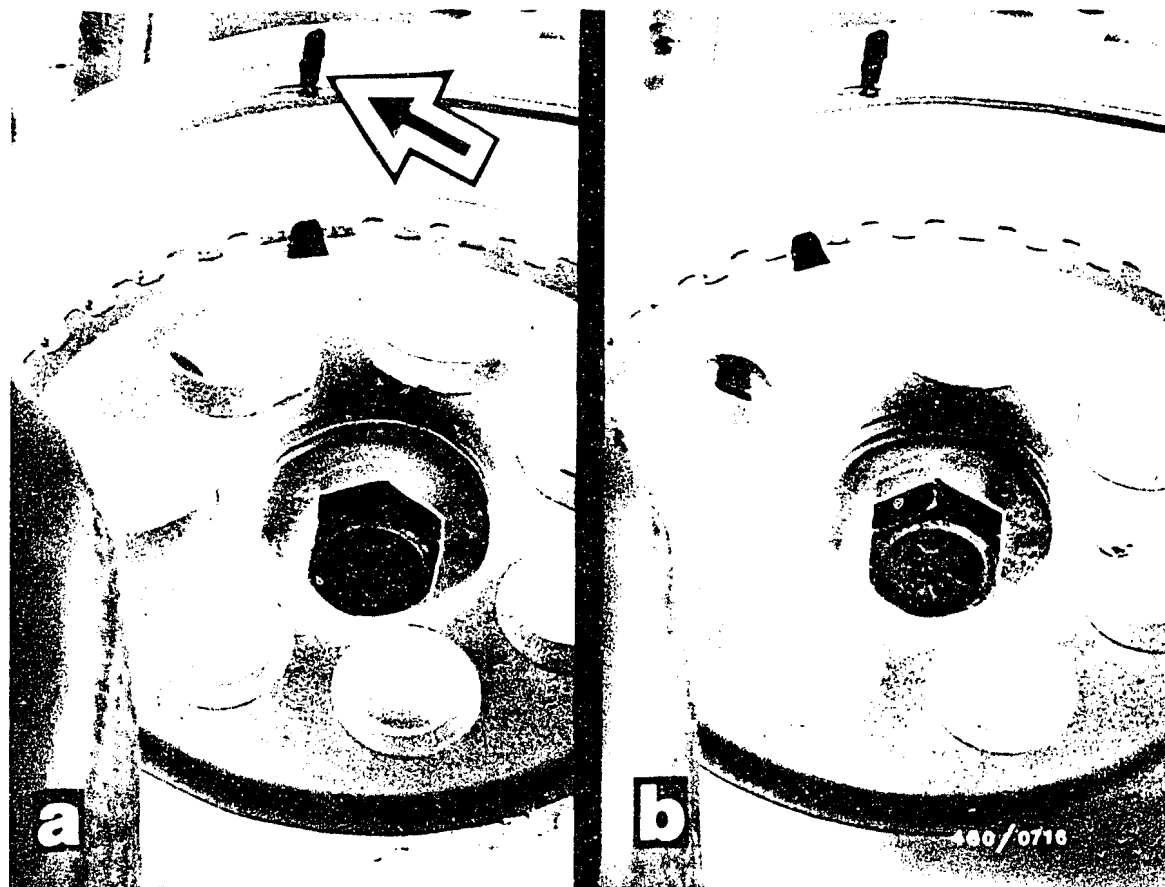
Remove toothed-belt protective cover and fuel filter.

4. Shift into gear and chock up left-hand front wheel.

By turning the front wheel, position piston of cylinder 1 (flywheel end) to TDC (left-hand illustration).

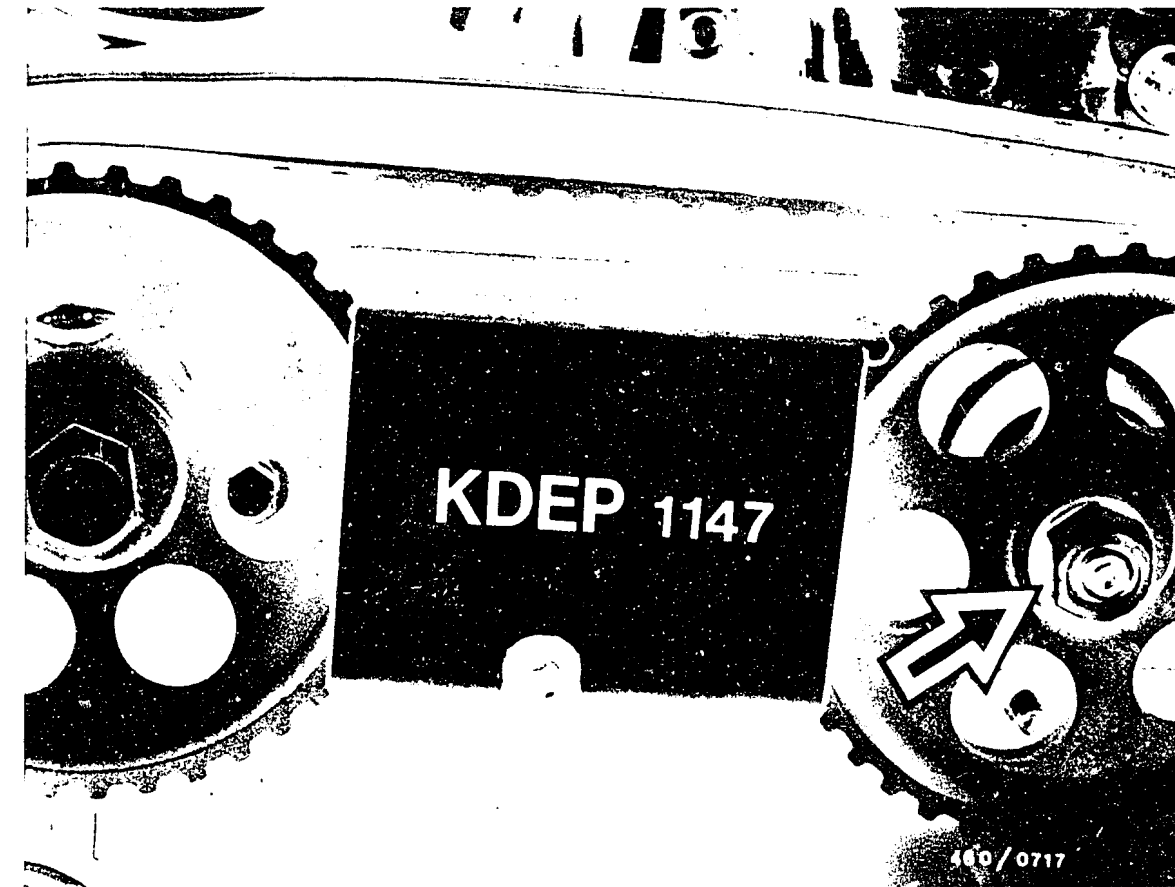
Check position of crankshaft using setting mandrel KDEP 1123 (right-hand illustration).

To do this, unscrew screw plug at engine block (near to flywheel).



At TDC, transfer markings on camshaft gear and injection-pump gear to timing-gear cover (illustration a, arrow).

Afterwards, turn timing gears back one tooth (illustration b).

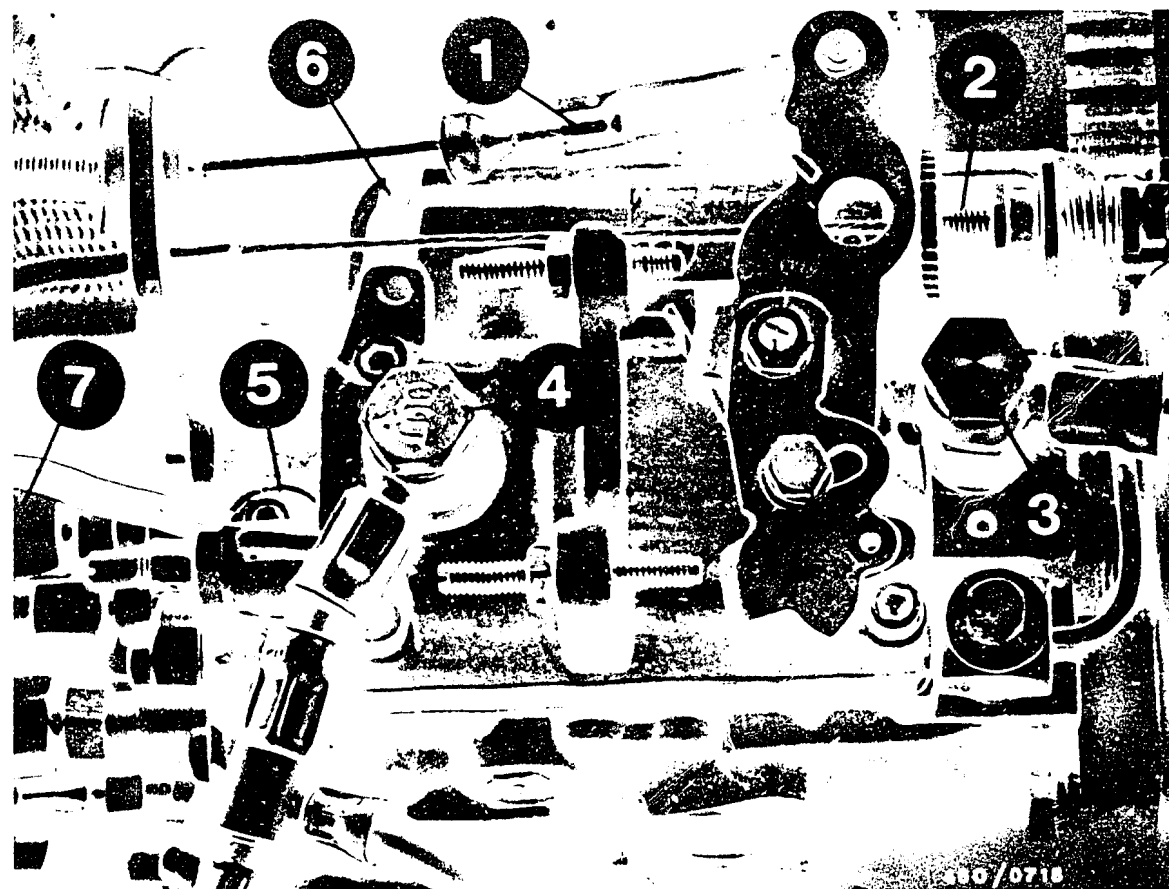


Insert holding device KDEP 1147 between camshaft gear and injection-pump gear (see illustration).

Loosen fastening nut of injection-pump gear (arrow) and screw on by approx. 2 turns.

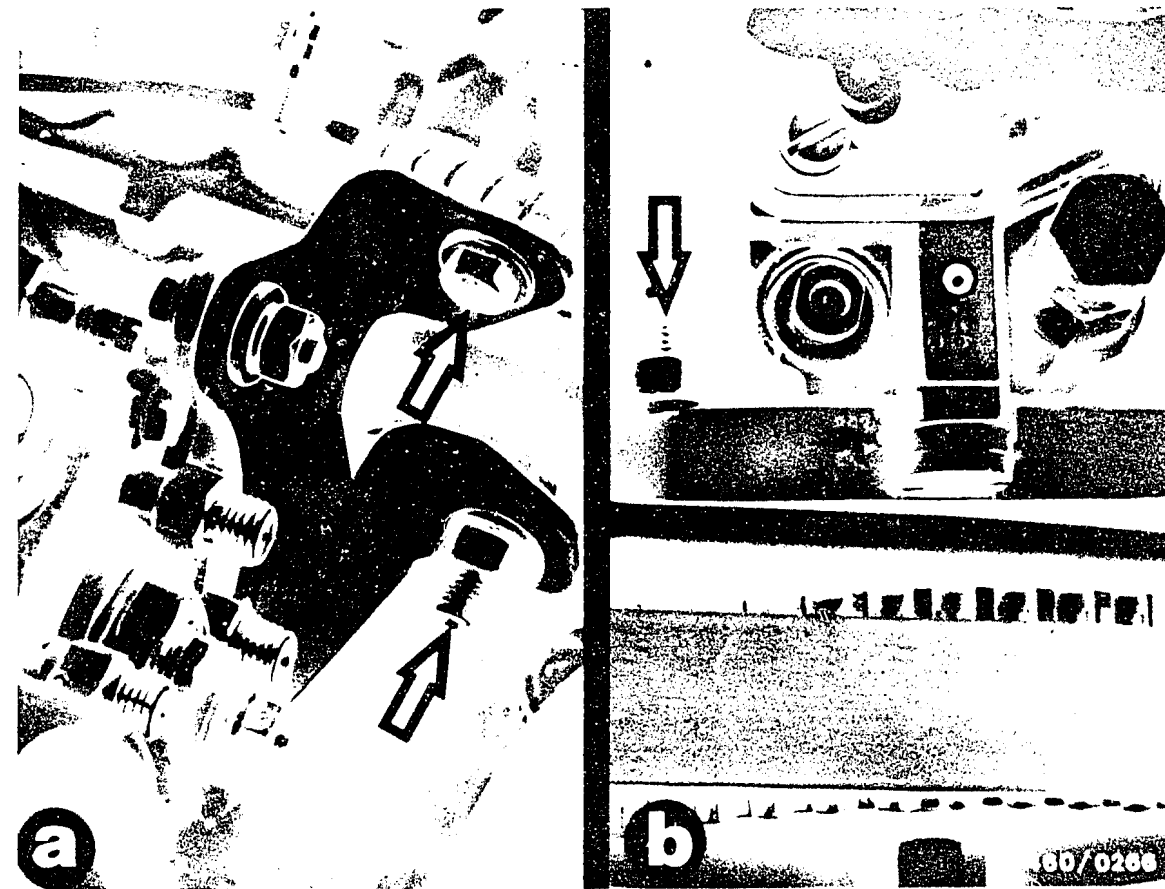
Loosen injection-pump gear using puller KDEP 1118.

Remove fastening screw and plain washer from drive shaft of injection pump.



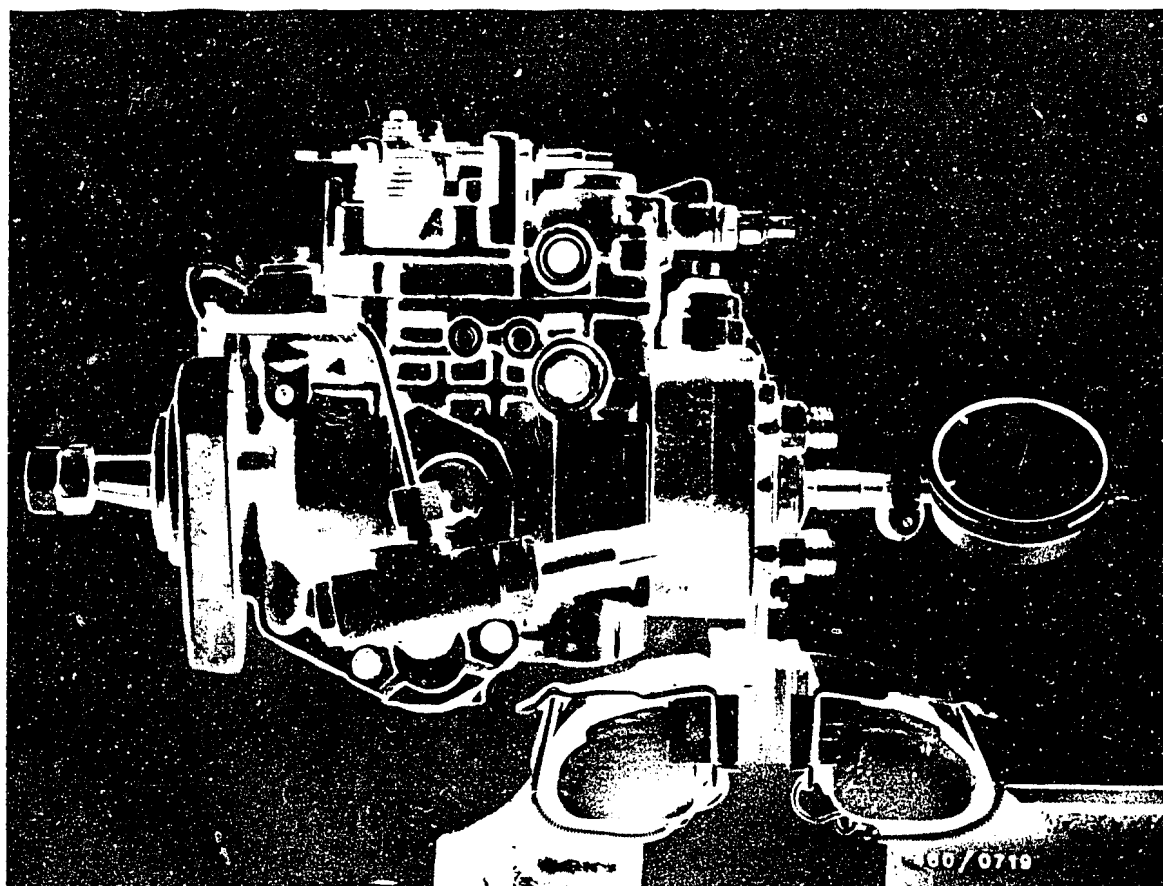
- 1 = Bowden cable at control lever
- 2 = Bowden cable, fast idle
- 3 = Fuel inlet line
- 4 = Fuel return line
- 5 = Connecting cable to electric shutoff device
- 6 = Connecting cable to cold-start accelerator
- 7 = Fuel-injection tubing

Remove cable at control lever of injection pump, cable for fast idle, fuel lines, electric-shutoff-device connecting cable, cold-start accelerator connecting cable and fuel-injection tubing. (Prevent the delivery-valve holder from loosening by counterholding).



Unscrew fastening screws of injection-pump angle bracket (arrows, illustration a).

Remove fastening nuts of injection pump at pump flange and remove injection pump (arrows, illustration b).



## 6. INSTALLING INJECTION PUMP

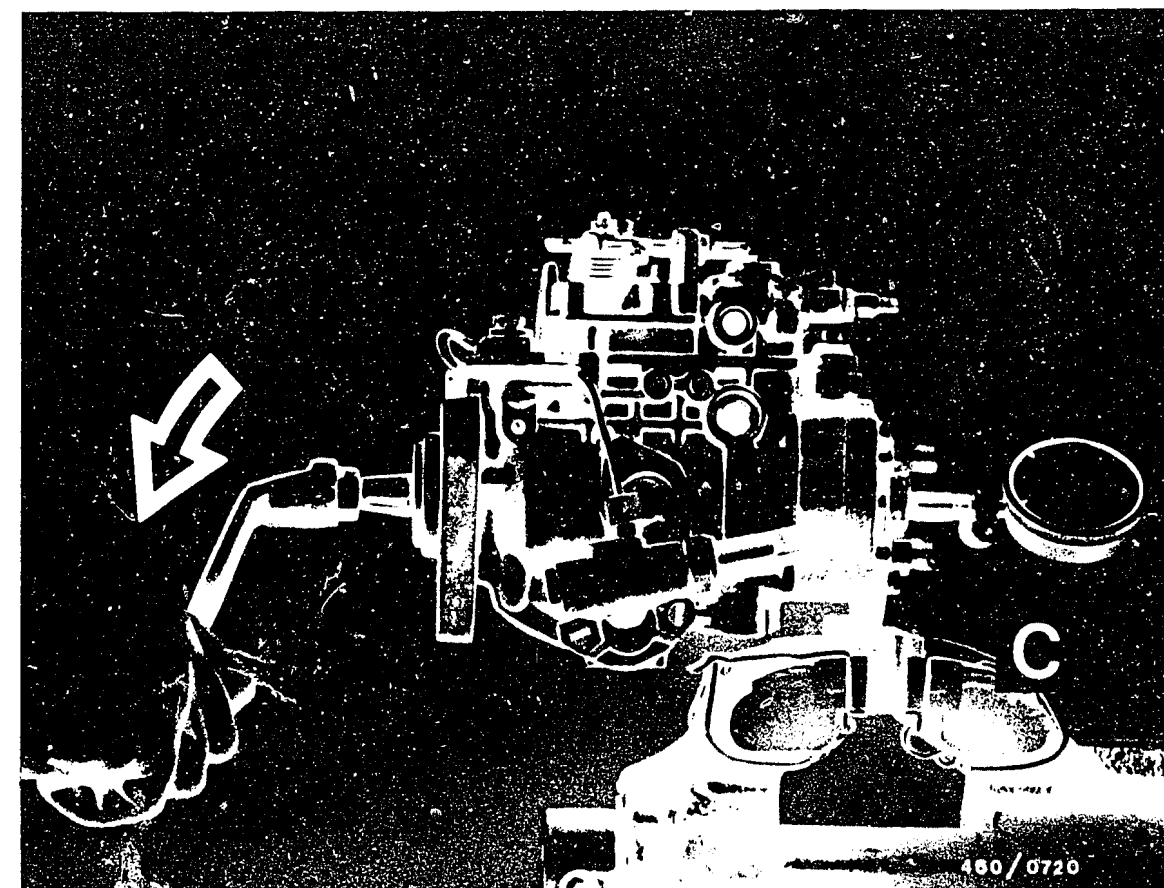
Clamp injection pump in vise (see illustration)

Screw two hexagon nuts onto drive shaft of injection pump and lock.

Remove bleeder screw of injection pump.

Mount measuring tool KDEP 1085 in tapped hole of bleeder screw.

Mount dial indicator 1 687 233 011 with measuring foot into measuring tool KDEP 1085 (see illustration).



Turn pump shaft in direction of arrow until BDC of distributor-pump plunger is obtained.

In this position, pre-load dial indicator approx. 3 mm and set to "0".

Turn drive shaft further in direction of arrow until the keyway (again at BDC position of distributor-pump plunger) points to outlet "C" (see illustration) of distributor head.

Unscrew hexagon nuts (do not turn drive shaft further).

Insert Woodruff key into slot of drive shaft.

Guide injection pump into bore of pump drive gear.

Screw on fastening nuts of injection pump by hand.

Mount washer and fastening nut of pump drive gear and tighten to 50 Nm.

Remove holding device KDEP 1147.

Turn crankshaft two revolutions in direction of engine.

At TDC of cylinder 1, lock crankshaft using setting mandrel KDEP 1123.

In this position, dial indicator at injection pump must indicate a plunger lift of 0.65 mm after BDC.

If necessary, correct by pivoting the injection pump.

#### Note:

Poor tensioning of the toothed belt adversely affects the pump setting.

Test toothed-belt tension using belt-tension test tool KDEP 1121.

Turn vernier sleeve until the lower edge of the sleeve is aligned with the marking on the measuring tongue.

Read off measurement.

Setting:                      Scale interval 13...14

#### Checking the setting

Remove setting mandrel KDEP 1123.

Turn crankshaft 1 3/4 turns in direction of rotation.

Check whether dial indicator is at "0" at BDC of distributor-pump plunger.

Turn crankshaft further until TDC (engine) and lock using setting mandrel KDEP 1123.

Dial indicator at injection pump must indicate a plunger lift of 0.63...0.67 mm.

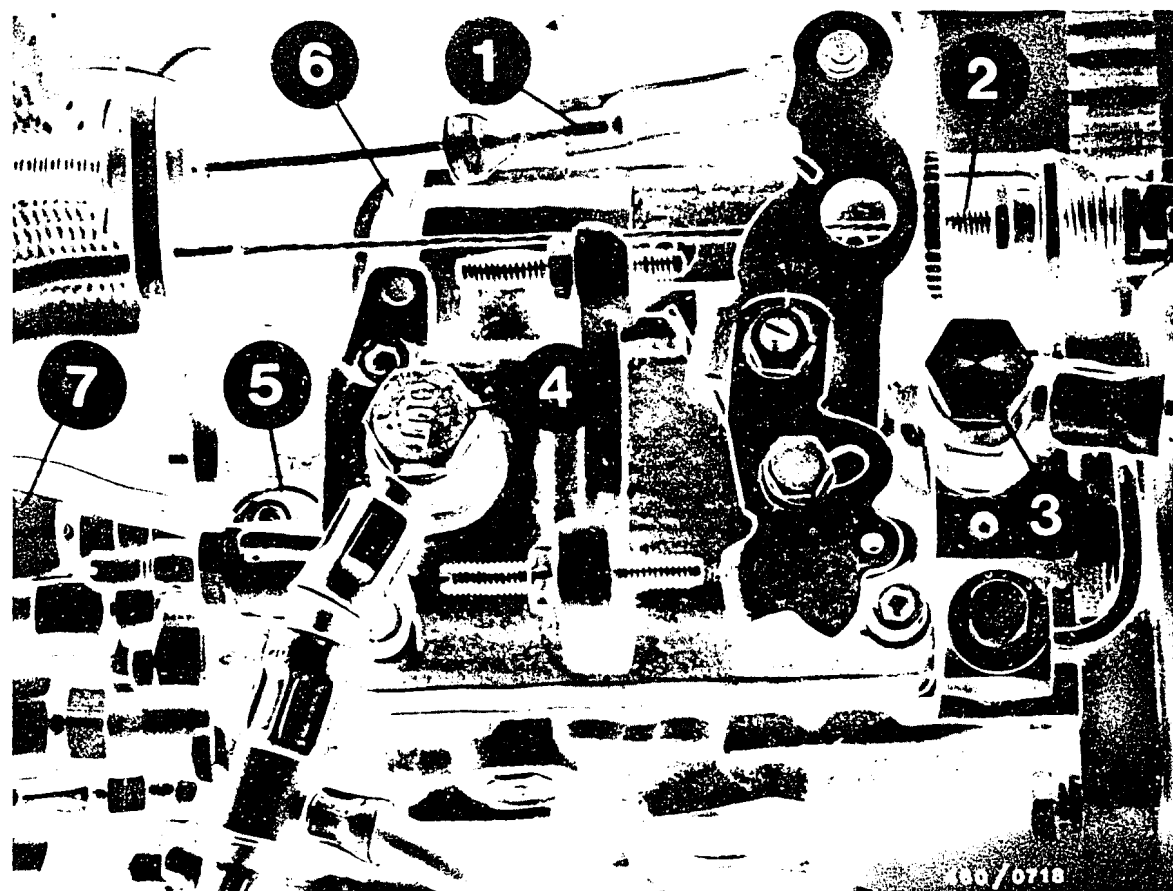
Remove setting mandrel KDEP 1123.

Tighten fastening nuts of injection pump to 25 Nm.

Remove measuring tool KDEP 1085 with dial indicator and mount bleeder screw with new copper sealing ring.

Mount angle bracket at distributor head of injection pump and tighten fastening screws.

Fit toothed-belt protective cover and fuel filter.



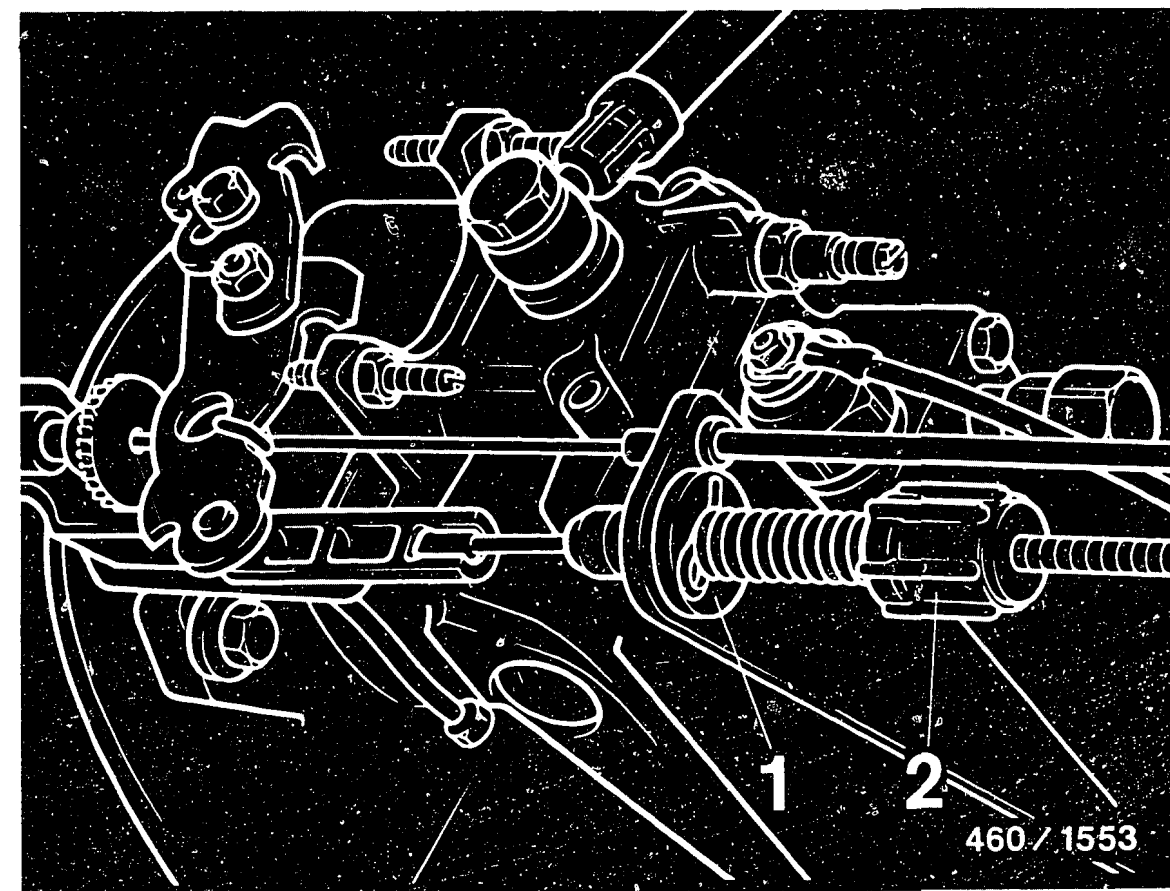
- 1 = Bowden cable at control lever
- 2 = Bowden cable, fast idle
- 3 = Fuel inlet line
- 4 = Fuel return line
- 5 = Connecting cable to electric shutoff device
- 6 = Connecting cable to cold-start accelerator
- 7 = Fuel-injection tubing

Mount cable at control lever of injection pump, cable for fast idle, fuel lines, electric-shutoff-device connecting cable, cold-start device connecting cable and fuel-injection tubing. (Prevent the delivery-valve holder from turning by counterholding).

Disconnect negative cable from battery.

#### Note:

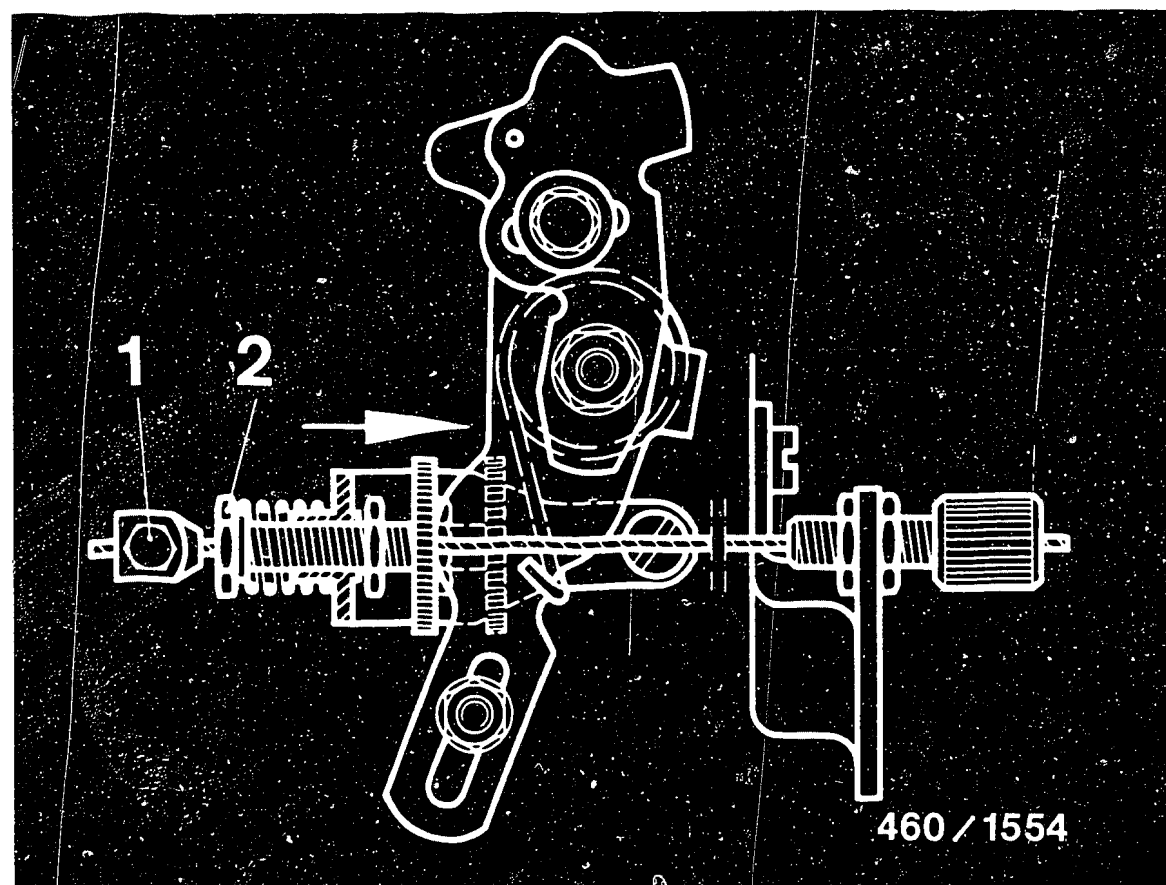
The hollow screw of the fuel return line is equipped with a restriction bore and marked "Out".



- 1. Fastening clamp
- 2. Compensating element

#### Note on throttle-cable adjustment:

Adjust fastening clamp in such a way that the compensating element is pinched by approx. 2 mm.



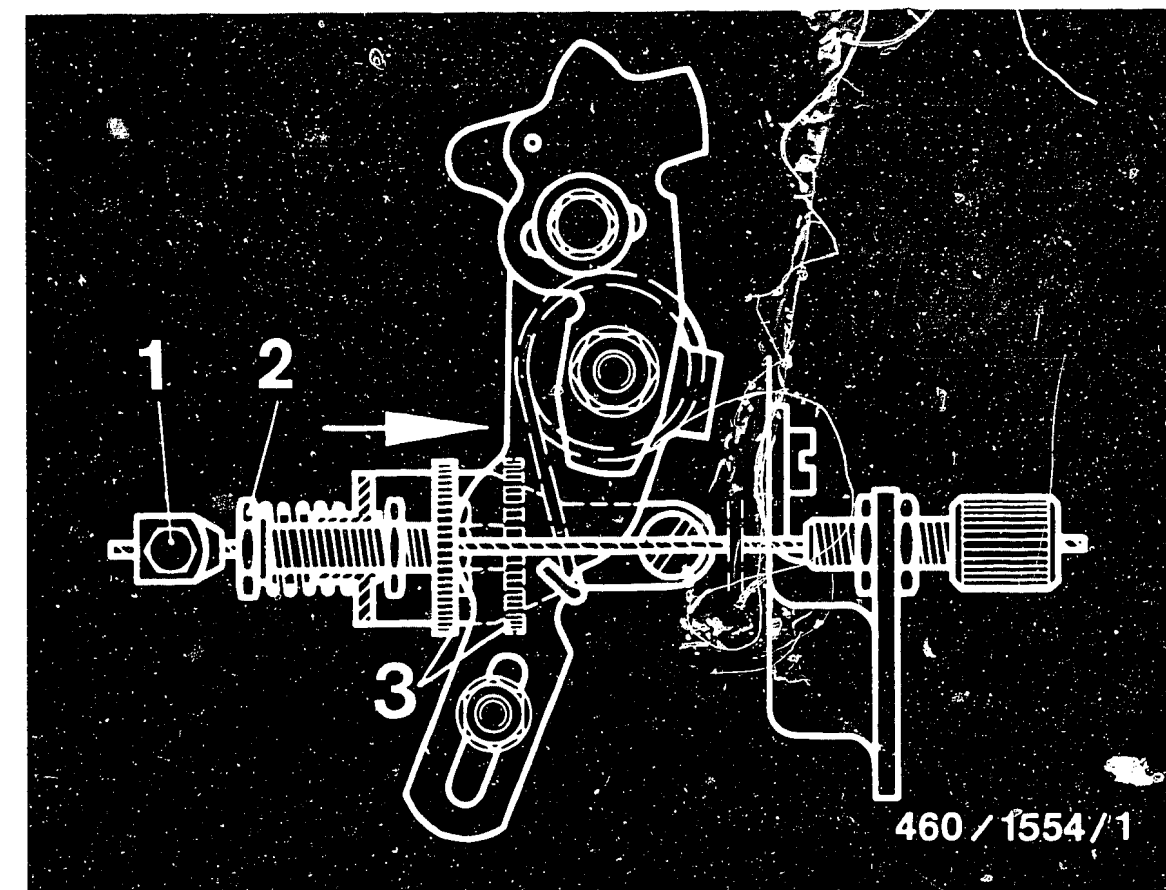
1. Clamping piece
2. Hexagon nut

#### Adjustment of fast idle:

Engine cold (coolant temperature below 30°C).

Press hexagon nut against spring resistance up to stroke end (direction of arrow).

Tension bowden cable, position clamping piece against hexagon nut and tighten.



1. Clamping piece
2. Hexagon nut
3. Knurled thumb screw

#### Adjustment of fast idle:

Engine warm (coolant temperature approx. 80°C).

Clearance between clamping piece and hexagon nut 0.5...1.5 mm.

Run engine at idle speed.

Actuate idle increase.

Set value: 1100...1200 min<sup>-1</sup>

Correction is necessary, adjust speed by turning the knurled thumb screw.



## 7. TESTING AND ADJUSTING ENGINE TIMING

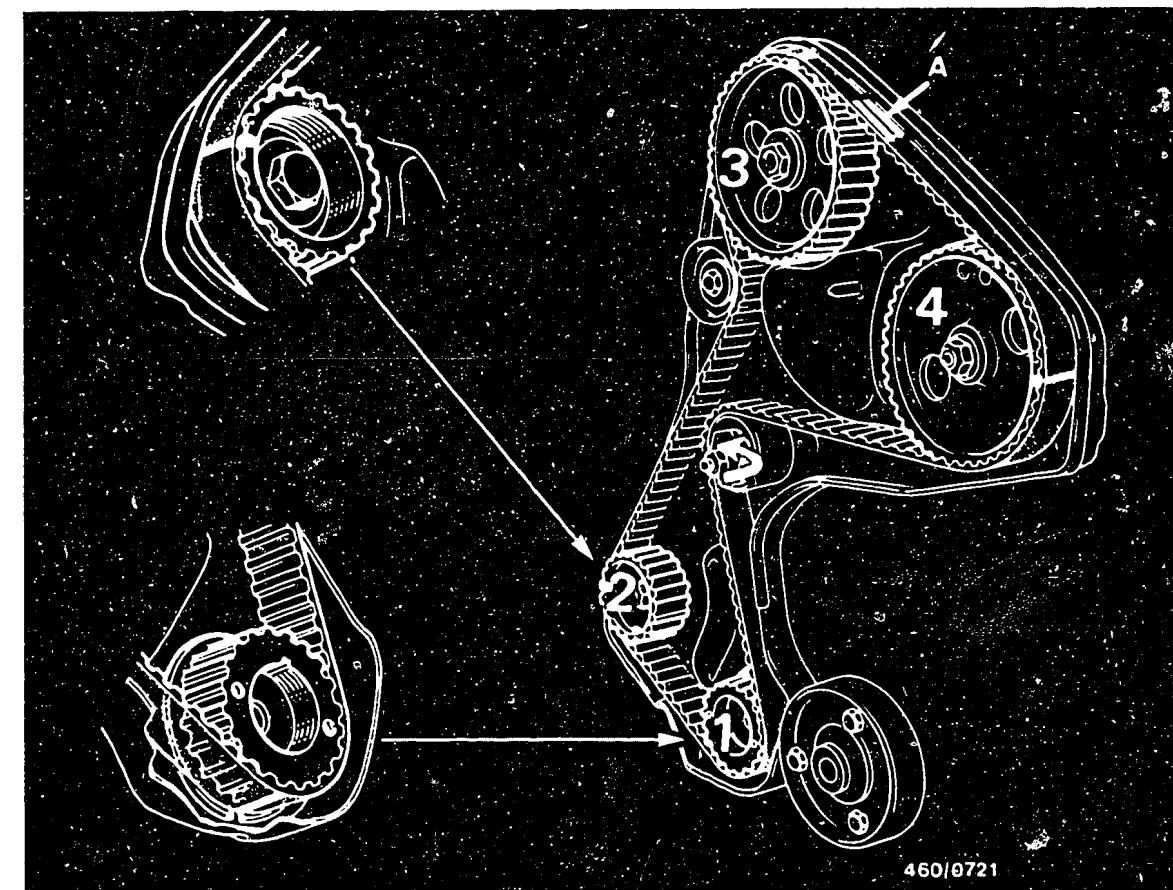
### 7.1 TESTING ENGINE TIMING

Remove cylinder-head cover and toothed-belt protective cover.

4. Shift into gear and check up left-hand front wheel.

By turning the front wheel, turn the crankshaft to TDC of cylinder 1 (cylinder 4 or valve overlap) and lock using setting mandrel KDEP 1123.

Remove V-belt from generator and pulley of crankshaft.

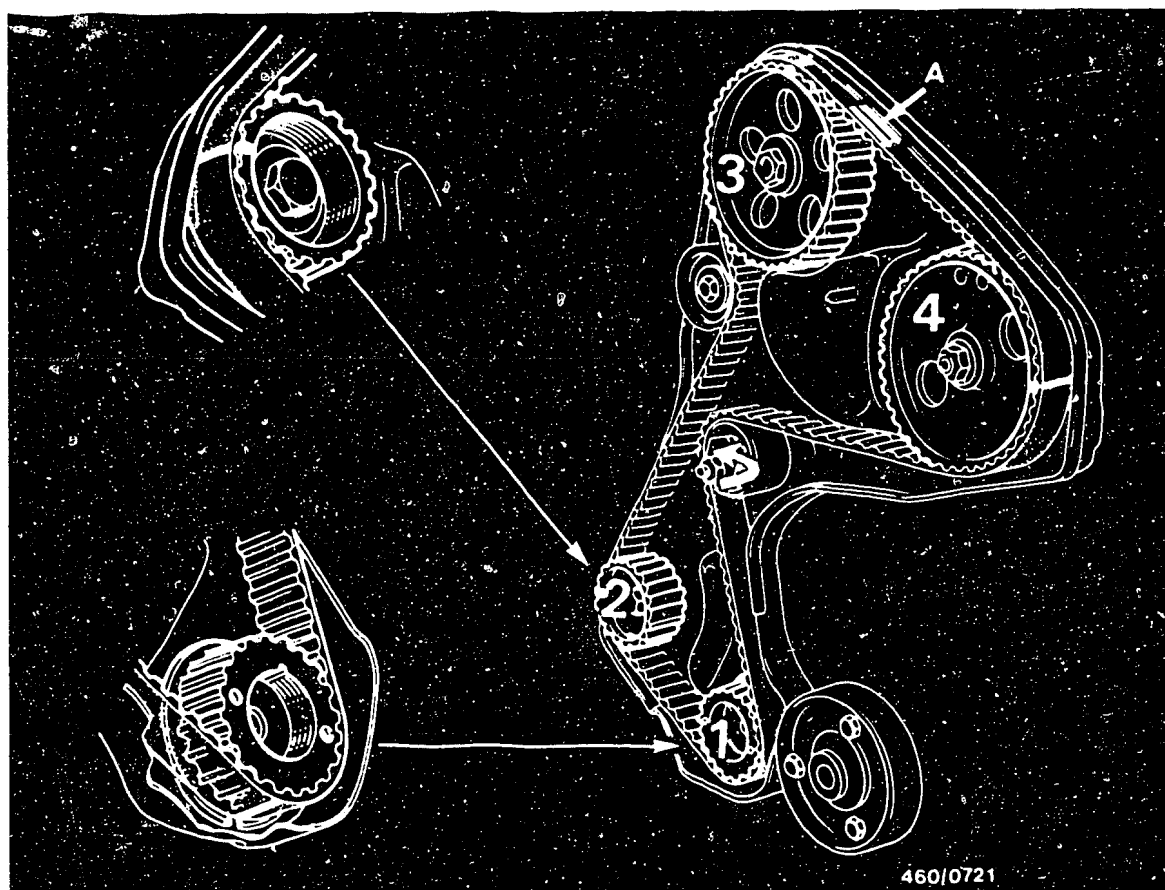


Check number of teeth of toothed belt between the markings of the toothed gears:

- 18 teeth between toothed gears 1 and 2
- 47 teeth between toothed gears 2 and 3
- 29 teeth between toothed gears 3 and 4

If these numbers of teeth are not obtained, the engine timing must be adjusted accordingly.





## 7.2 ADJUSTING ENGINE TIMING

Loosen toothed-belt tensioning roller and remove toothed belt.

Test whether setting mandrel KDEP 1123 is locking crankshaft at TDC of cylinder 1.

Align markings of toothed belt and timing gears.

Position toothed belt on timing gears in following sequence: 1 - 2 - 3 - 4..

Remove setting mandrel KDEP 1123.

### Note:

Arrow markings on toothed belt (arrow A) indicate direction of assembly and must be positioned between camshaft gear and injection-pump gear.

Set toothed belt to scale interval 13...14 (in accordance with belt-tension tester KDEP 1121) by turning the tensioning roller counterclockwise.

Tighten fastening nut of tensioning roller to 40 Nm.

Turn crankshaft of engine two revolutions.

Lock crankshaft at TDC of cylinder 1 using setting mandrel KDEP 1123.

Check toothed-belt tension and number of teeth of toothed belt between the markings of the toothed gears once again.

18 teeth between toothed gears 1 and 2

47 teeth between toothed gears 2 and 3

29 teeth between toothed gears 3 and 4

Remove setting mandrel.

Tighten pulley of crankshaft to 100 Nm.

Position V-belt of generator and tension.

Mount cylinder-head cover and toothed-belt protective cover.

Test coordination, pump - engine (injection timing):

Testing/adjusting "static"

Engine position: Cyl. 1 at TDC

Setting value:

Pump position: 0.63...0.67 after BDC

Check value:

Pump position: 0.65 after BDC

Testing "dynamic"

Engine speed 825...875 min<sup>-1</sup>

Start of injection 10.5...12.5° before TDC